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THE ROGUE RIVER COUNTRY OF OREGON: A STUDY IN REGIONAL GEOGRAPHY*

Samuel N. Dicken

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Regional study is as old as Geography itself but neither subject is, by any means, a static one. The character of regions is constantly changing and even more changeable are the geographers who study them. New definitions, approaches, methods, and techniques are constantly coming to light, and penetrating criticisms of the regional method are heard occasionally from some of the more highly specialized geographers. Regional studies have been somewhat neglected by geographers of late, but workers in other disciplines, from English Literature to Political Science, have hopped on the regional bandwagon. Regional studies, of course, do not belong exclusively to geography, but if geographers forsake them, engineers, historians, or even philosophers will leap into the breach. In recent years some signs of a revival in regional geography (by geographers) have appeared: A Committee of the Association of American Geographers has been working for more than two years on the subject "Regional Study, with Special Reference to Geography."[1]

It seems appropriate, therefore, for the individual geographer to re-examine his goals, techniques, and methods and to test them in the crucible of field study. The Rogue River Country offers a challenge to regional investigation, but both the region and the subject of regional study are so complex that this brief paper can be considered a progress report only. The first problem in regional study is to select and define the region. In southwestern Oregon three choices were considered:

1. Diller's definition of the Klamath Mountains[2] (Oregon portion).

2. The watershed of the Rogue River, plus that of the smaller coastal rivers.

3. County boundaries, specifically those of Curry, Josephine, and Jackson counties.

In the beginning of this study the region was thought of as "The Oregon Klamath Mountains." It soon became obvious, however, that this is not a suitable geographic unit since it excludes the west slope of the Cascade Range which is of great significance to the upper Rogue River Country. The watershed of the Rogue River (fig. 1), together with smaller rivers near the coast, form a fairly satisfactory unit, largely because the divides are in areas of sparse population. Finally, the county boundaries were selected since they follow the drainage divides rather faithfully on the north and approximate the divides elsewhere. The province thus defined is approximately 110 miles east-west by 55 miles north-south. The total area of the three counties is slightly more than 6,000 square miles, a little more than six per cent of the total area of the state.

*Presidential address of the Association of Pacific Coast Geographers, Corvallis, Oregon, June 20, 1952. Field study was aided by a grant from the Graduate Research Fund of the University of Oregon.

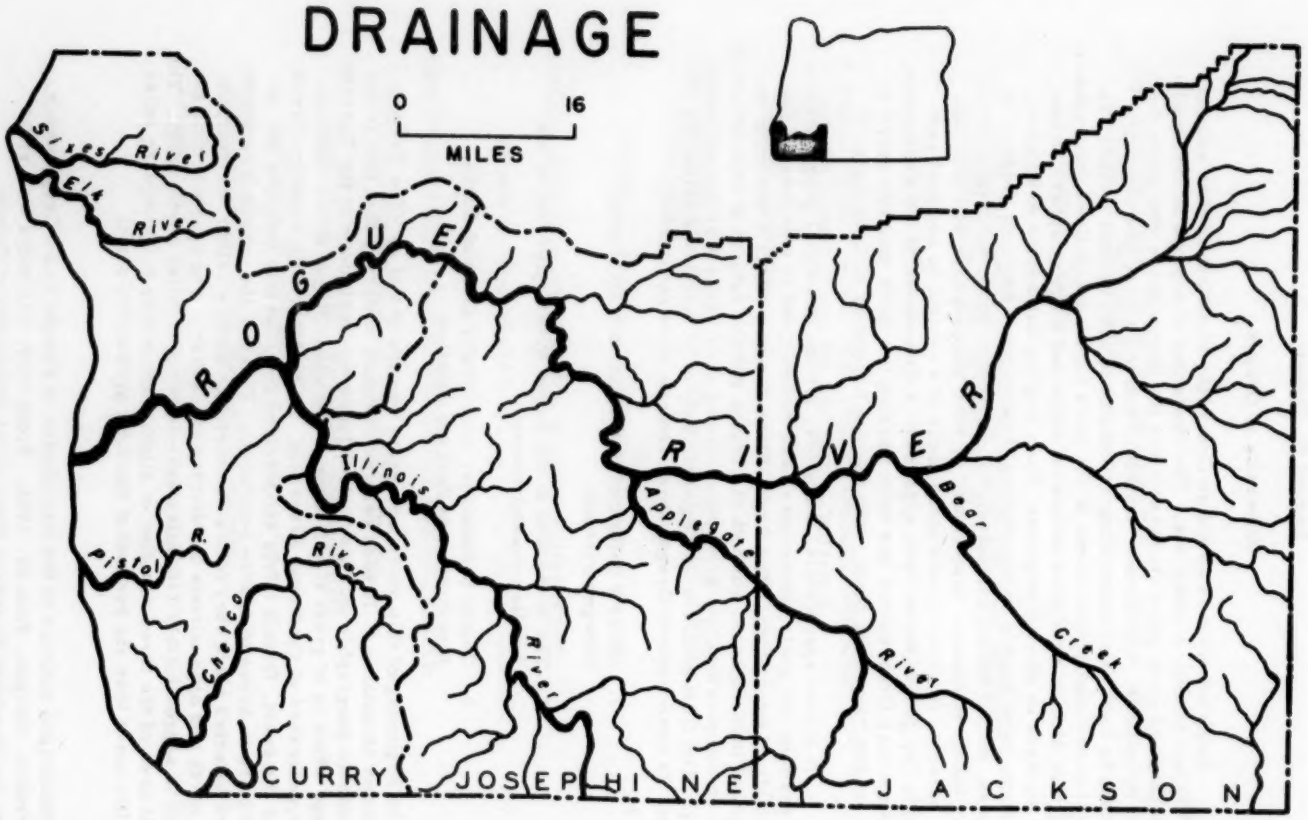

Fig. 1. Drainage map of the Rogue River Country. Three counties, Curry, Josephine, and Jackson (in order from west to east) form a satisfactory geographic unit, since their land boundaries follow or approximate drainage divides.

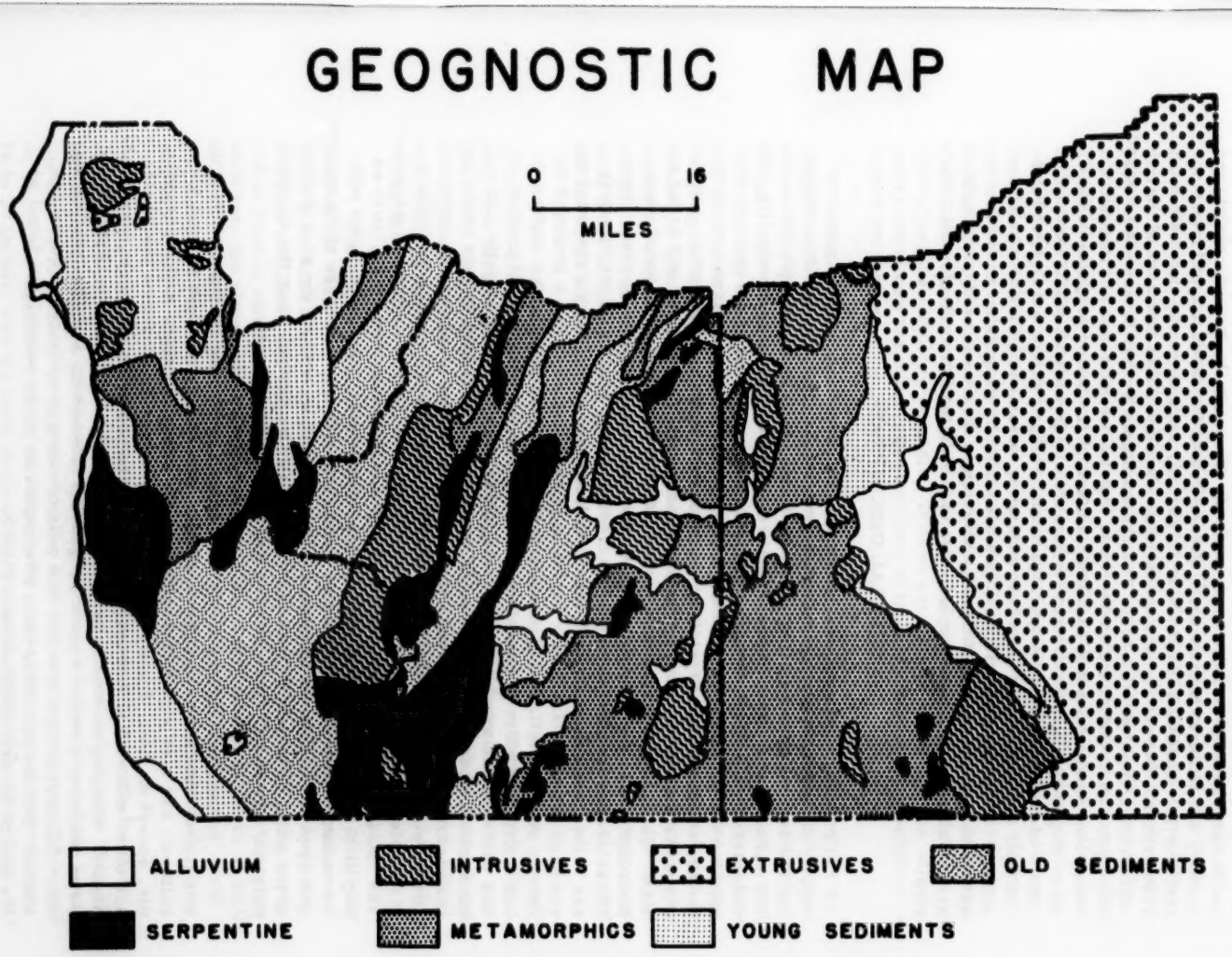

Fig. 2. A geognostic map of the Rogue **River Country**, generalized from geologic maps.

With a few notable exceptions, the Rogue River Country has been only slightly investigated. Great progress has been made in geology by the United States Geological Survey and the Oregon State Department of Geology and Mineral Industries.[3] All the region has been mapped topographically, mostly on the scale of 1:125,000, excepting only the southwest corner. Forest Service aerial photos are available for most of the region, on a scale of 1:20,000. The United States Forest Service has mapped the vegetation cover on the scale of one inch to one mile and the United States Reclamation Service has made studies of irrigation projects in the upper Rogue and Illinois basins. A number of agricultural studies have been made by the United States Department of Agriculture and Oregon State College, and the results have been published in various bulletins and periodicals. Surprisingly little work has been done by geographers. Noteworthy exceptions include Willis B. Merriam's thesis on the Upper Rogue River Valley[4] and the geographic work of the United States Reclamation Service.

GENERAL DESCRIPTION

The Rogue River Country is a complex province, involving a great variety of natural and cultural landscape features. Of primary importance are the various rock types, highly complicated in pattern and structure. The salient features can be presented in a generalized geognostic map (fig. 2). compiled from geologic maps. But field observations are necessary to determine the geographic significance of these formations, in terms of landforms, soils, natural vegetation, and human life. Of great human consequence is the alluvium occurring on the terraces, floodplains, and broad basins. The younger sediments, mainly of Tertiary Age, are found near the coast and to a lesser extent along the west margin of the Cascade lavas. These sediments consist largely of sandstones and shales, some of which are rather weak and unconsolidated, while others, especially the greywackes, are hard and resistant. This variation in resistance has had a profound influence on the detailed configuration of the coastline, and on the landforms and soils. The older sediments occur chiefly in the west central portion of this province and are often complexly folded and sometines slightly altered. Sandstones, conglomerates, shales, and some interbedded igneous rocks are included. The extrusive rocks consist mainly of unaltered basalt, andesite, and rhyolite, mostly in the form of flows. The intrusive rocks are widely distributed, consist mostly of granodiorites and basic rocks, such as gabbro. The "metamorphics" include altered sediments and igneous rocks, such as argillite, chert, quartzite, and marble. Serpentine, usually included with the metamorphic rocks, deserves special consideration because of its susceptibility to landslides and other mass movements, as well as the poor quality of its soils. The serpentine areas can usually be spotted from the air since they are correlated with scrubby, non-commercial forest.

Associated with the above rock types are various landforms, vegetation types, and land use patterns, although other factors, both natural and cultural, are also significant. Much of the coast is rugged and inaccessible, except on foot. Small, cirque-like coves are developed on the shales and other soft rocks, and nearly vertical promontories on the harder sandstones. Hanging waterfalls are common, but the steep slopes, reduced by wave action, are reduced more by gravity movements than by running water. Offshore from a few feet to a mile or more are numerous rocky sea stacks. Narrow beaches, often interrupted by rocky points, are found at the foot of the sea cliffs in many places.

Alluvial plains are found along the coast in the form of marine terraces and in the interior in the form of river floodplains and old river terraces that now lie well above the flood level. One plain extends from the northwest corner of the province in the vicinity of Floras Lake and Cape Blanco to the vicinity of Port Orford. A small narrow plain is found immediately to the north of Gold Beach along the coast. Still another alluvial plain begins north of Brookings and extends into California. The most important plain in the interior is found in the vicinity of Medford and Ashland. This plain is known as the Rogue River Valley although most of it lies in tributaries to the Rogue rather than in the Rogue itself. This plain may be considered as extending to the north of the Rogue to include Sams Valley. Farther down the Rogue in the vicinity of Grants Pass is another alluvial plain of some considerable extent, although smaller than the Medford area. Still another plain lies in the upper Illinois drainage in the vicinity of Kerby, Cave Junction, and O'Brien. Smaller alluvial plains are found in many localities along the tributary streams. It need scarcely be noted that the alluvial plains constitute the most important part of the region from the standpoint of human occupance.

Rising above the marine terraces, floodplains, and coastal cliffs is rugged hill country. Here slopes are steep and narrow canyons are common where the superimposed streams cut through resistant ridges. Landforms include high marine terraces, valley-in-valley profiles, landslide forms, and rock benches based on the more resistant layers. In the areas of greater relief such as the Siskiyou section of southwestern Jackson County, elevations range up to 7,500 feet. This mountainous country shows some evidence of moderate glaciation and granitic rocks have been eroded in characteristic rounded summits and spurs. Finally, on the eastern margin of the province, which represents a portion of the Cascades, flow lavas, tuff, and pumice occupy most of the surface. The western portion of this district is dissected, the eastern, higher part is comparatively smooth.

The drainage pattern of the province has special meaning for communications as well as for the definition of boundaries. The Rogue River (fig. 1) lies near the northern boundary of the province. North bank tributaries are generally short, while many of the south bank confluents such as Butte Creek, Bear Creek, Applegate River, and the Illinois River are much longer. Several smaller rivers, the Sixes, Elk, Pistol, Chetco, and Winchuck, lead directly to the sea.

The Rogue River takes a torturous course from the vicinity of Crater Lake to the sea. The upper reaches have a steep gradient and a great many large falls and rapids. As the river approaches the vicinity of Medford the gradient declines, and it becomes a gentle stream, flowing across the north end of what is commonly called the Rogue River Valley. To the northwest of Medford, the river enters a shallow gorge and flows through a series of rather gentle rapids to Grants Pass. Here the river turns sharply to the north and flows at first through rather open hilly country but soon enters the Canyon of the Rogue which continues almost to the sea.

The climate of the Rogue River Country is rather variable for such a small province. Rainfall ranges from 16 inches at Medford to more than 100 inches (estimated) on portions of the western slopes. Coastal stations average nearly 70 inches; the higher slopes a few miles inland receive 100 inches or more; the western interior has nearly 50 inches; the alluvial basins from 16 to 30 inches, and the west slope of the Cascades from 30 to 60 inches. All stations show a high winter concentration of rainfall. January temperature averages vary from approximately 26° F. on the higher elevation in the east

to about 46° F. on the coast. The July range is from 57° F. on the coast to 72° F. in the interior basins.

The natural vegetation includes grassland, chaparral, hardwood scrub forest, mostly oak-madrone, and various kinds of coniferous forest. Along the coast is the spruce-hemlock forest with patches of chaparral, including manzanita, huckleberry, wild iris, salal and others, also some grassy areas. The cut-over, burned-over forest has been replaced in many cases by chaparral. The douglas fir forest is widely distributed from very near the coast to the higher Cascades. The western cedar and port orford cedar are found in rather small areas in the western district. The pines are found mostly in the interior and generally at lower and intermediate elevations. Hardwoods are most extensive in the drier eastern districts at low elevations and in southern Curry County. Small areas of redwood are found along the Chetco and Winchuck rivers also in southern Curry County. No large part of the province has escaped serious forest fires, from the time of early Indian occupation to the present.

The population of the three southwestern Oregon counties, Curry, Josephine, and Jackson, was 91,000 in 1950 (fig. 3). This represents an increase of 60% in the previous decade, an increase associated with the expansion of lumbering, agriculture, and recreation. Most of the people live in the vicinity of Medford and Grants Pass. Smaller concentrations are found in the upper Illinois Valley and along the coast. Large areas in eastern Curry and western Josephine counties have no permanent population. The largest city is Medford with 17,305 in 1950 while Grants Pass had 8,116 and Ashland 7,739. Only two other towns, Jacksonville and Central Point, had as much as 1,000 people in 1950.

Productive occupations include lumbering, manufacturing of wood products, agriculture, ranching, food processing, mining, and recreational activities. Commercial fishing is of little importance because of the lack of harbors, and mining, although widespread and subject to sudden spurts, employs few people. In recent years lumbering has increased rapidly, especially on privately owned land. The partial depletion of timber reserves in Washington and northwestern Oregon has tempted many lumbermen to migrate to southwestern Oregon. Many new mills have been constructed, including plywood and other processing plants. The greatest percentage increase in lumber production has been in western Curry County where extensive private holdings are available. It is likely that most of this private land will be cut over in from 5 to 10 years. Conservation measures, such as sustained yield programs, are not being used extensively in the province at the present time.

Lines of communication in southwestern Oregon are limited by the rugged terrain and the sparse population. Two main highways provide access to the Willamette Valley and California. The Coast Highway (U.S. 101) has no important feeder roads in the province. Highway 99 has a feeder from northwestern California (U.S. Highway 199) which also serves the upper Illinois Valley. A paved highway connects Medford with Crater Lake and another joins Ashland with Klamath Falls. Although many short private logging roads are found throughout the province, many parts are entirely without all-weather roads. It will be noted that the coastal districts have no road connections with the interior. Highway 99 carries the heaviest traffic, although much of the through traffic from California to the Willamette Valley bypasses the province via Klamath Falls. Medford with the only large airport in the province is served by United Air Lines, West Coast Airlines, and Southwest Airways.

The brief descriptions presented so far have served but to suggest the nature of the problems to be encountered in the regional study of the Rogue River Country. In order to study effectively such a complex province, a plan was worked out involving four categories of investigation, corresponding to area sizes and intensity of study (fig. 4). In increasing order of size these levels are: (1) the landscape, (2) the locality, (3) the district, and (4) the province. These terms are not new and all have been used by geographers before in various shades of meaning. The Committee on Regional Study, mentioned above, uses all except the first. For the sake of clarity and brevity the definitions below are stated affirmatively but with no intention of being arbitrary. Obviously other geographers may properly disagree. It is hoped, however, that eventually a series of generally accepted definitions can be worked out.

The level of detailed investigation is the landscape, which has long been used in the popular sense to include what one can see clearly from a point of vantage. The landscape corresponds to a working scale of approximately 1:10,000, common in recent large scale aerial photographs. It seems unwise to define the landscape in terms of property lines, settlements, physical features, or any other single geographic feature. Rather the landscape should be chosen to represent the salient qualities of land and people within the radius of half mile or thereabouts. The study of each landscape involves the mapping and presentation of the landforms, the land materials, the natural vegetation cover, and the land use as a minimum. It seems desirable not only to portray and describe the landscape, but to explain it. If time or space does not permit the analysis and description of landscapes then the next larger category, the locality must be used.

The locality is a unit with some landscape diversity corresponding, for example, to two or three small scale aerial photos, 1:20,000 or smaller. The locality may be represented by a village, a small town, or cluster of farms, together with their environs. Or it may include forest land, grassland, or other areas without human habitation. The boundaries of the locality can be drawn so as to present the greatest variety of landscapes without too much sacrifice of compactness.

The next level of study, the district, is usually represented by the topographic maps available, most of which are 1:125,000 in the Rogue River Country. Criteria for the definition of districts will vary, but since the drainage pattern limits the movements of people and goods, a drainage map can be used to mark out fairly compact areas, if more satisfactory means are not available. The first of the four districts comprising the Rogue River Country, lies near the coast and includes most of Curry County. The upper Illinois and the middle Rogue are connected by a main highway through an easy pass and form a second district. The upper Rogue lowland and adjacent hill land represented by Phoenix and Sams Valley make up a third district. The slopes of the Cascade Range, tributary to the upper Rogue lowland but distinct from it, represent the most easterly district. Each of these districts has considerable diversity in quality within its own borders which the landscape and locality studies are intended to portray.

The final level of investigation is the whole Rogue River Province. The term "province" is used since the term "region" has too many shades of meaning. The province which must be studied as a whole as well as its parts, is usually represented on a scale of 1:500,000, more or less.

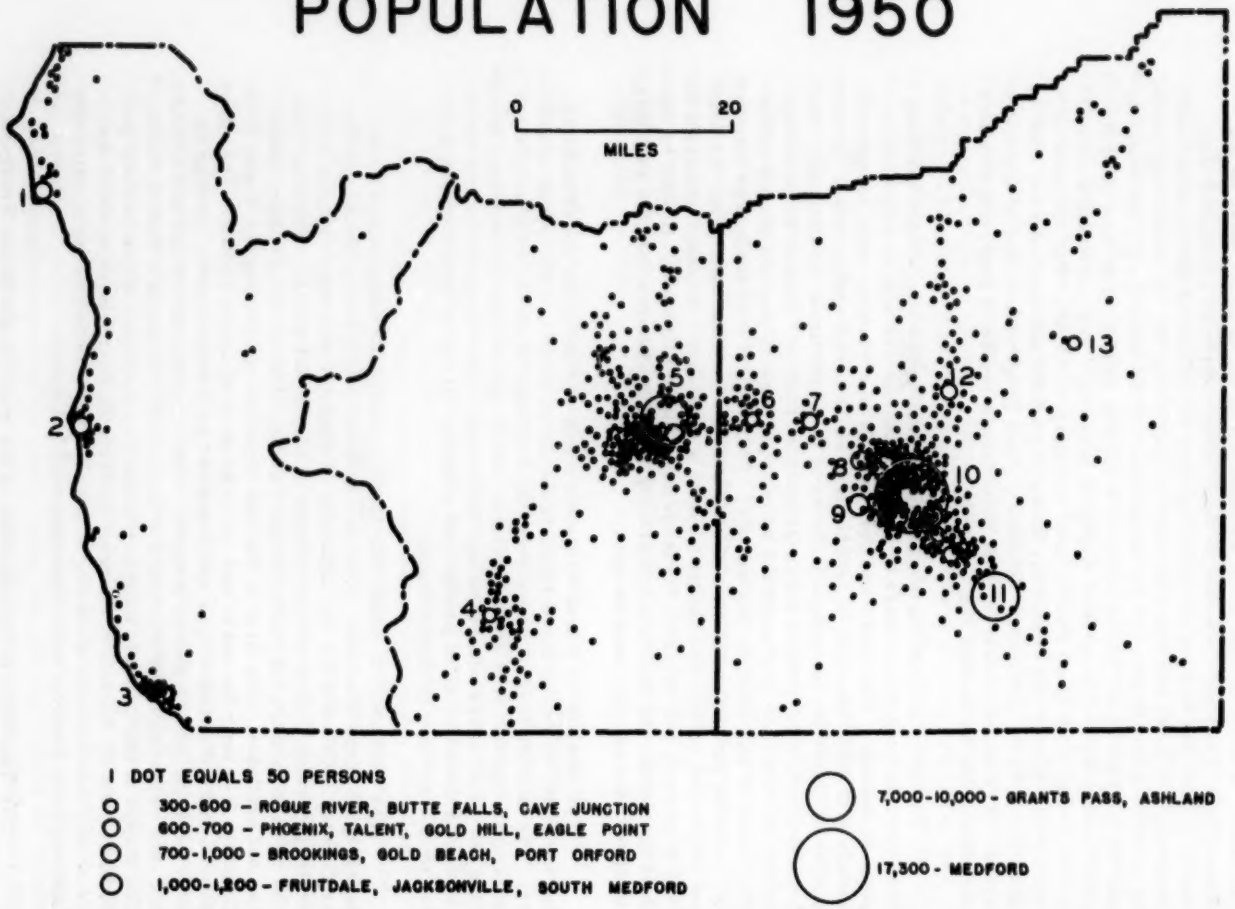

Fig. 3. Population map of the Rogue River Province, 1950. The location of the principal cities and towns is indicated by number: 1. Port Orford; 2. Gold Beach; 3. Brookings; 4. Cave Junction; 5. Grants Pass; 6. Rogue River; 7. Gold Hill; 8. Central Point;. 9. Jacksonville; 10. Medford; 11. Ashland; 12. Eagle Point; 13. Butte Falls. Phoenix and Talent lie between Medford and Grants Pass. Fruitdale is immediately south of Grants Pass.

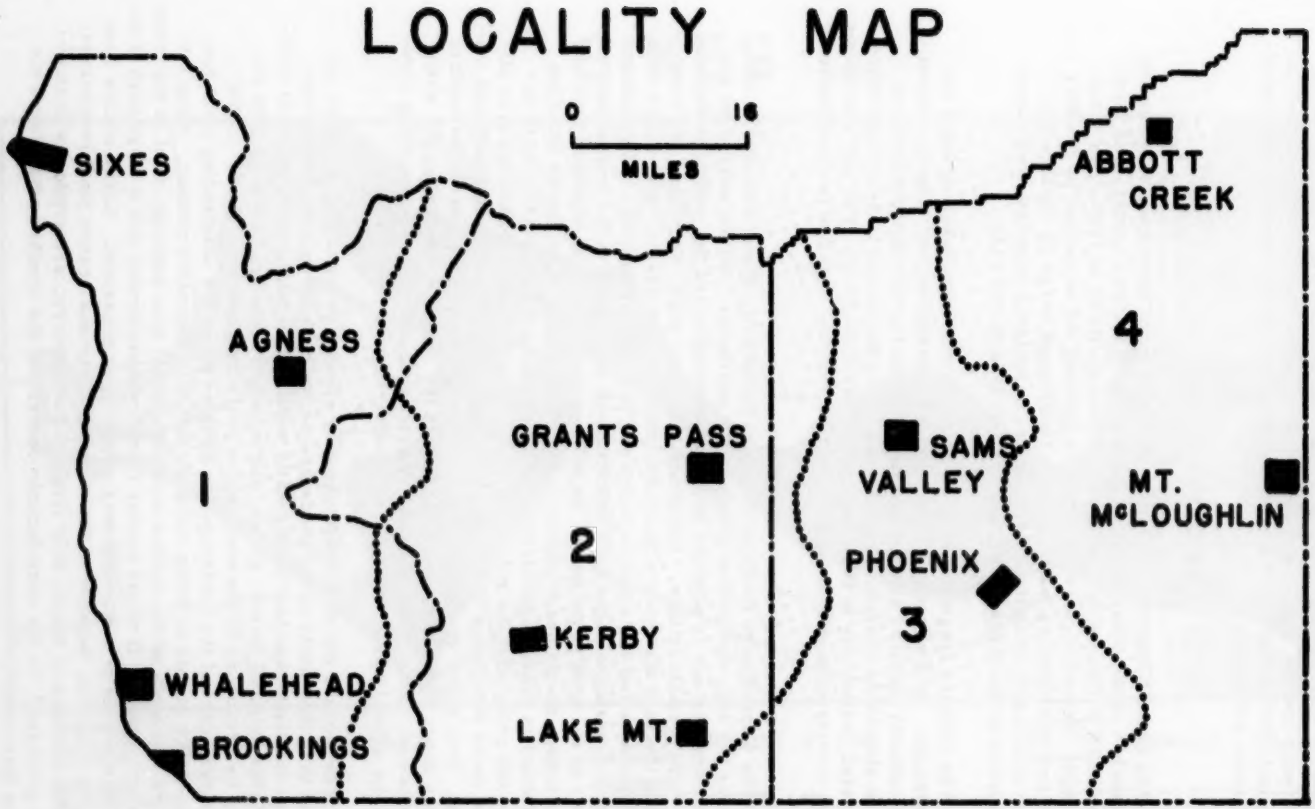

Fig. 4. The Rogue River Province is divided into four districts: 1. Coastal; 2. upper Illinois-middle Rogue; 3. Medford; 4. Cascade. The province is represented by eleven localities, each of which includes two or more landscapes.

Eleven localities, each representing two or more landscapes, were chosen to represent the Rogue River Province: Sixes, Whalehead, Brookings, Agness, Kerby, Lake Mountain, Grants Pass, Sams Valley, Phoenix, Abbot Creek, and Mt. McLoughlin. The Sixes Locality will be presented in some detail, but because of the lack of space, others will be described briefly, and some not at all.

THE SIXES LOCALITY

The Sixes Locality (fig. 5) covers about eight square miles along the lower reaches of the Sixes River in northwestern Curry County. The locality is outlined in three sidelapping aerial photos, flown in 1940, at a scale of 1:20,000. Section lines were added to indicate the scale and to simplify comparison with existing maps. Three landscapes occur in the locality: the marine terrace, with its eroded edges, associated beaches, and dunes; the floodplain of the Sixes River; and the hill land on the east.

The isolated fragment of the terrace on the west makes an ideal initial landscape. It is about one square mile in extent, rather simple in form and the cultural features are limited to a lighthouse, an abandoned placer mine, an abandoned church, and one road. The floodplain is somewhat more complicated, especially in the vicinity of Sixes Postoffice. The hill land shows greatest variety of landforms and vegetation, but the land use is comparatively simple.

The Cape Blanco terrace, the first landscape, rises from 200 to 250 feet above the sea, and slopes gently to the northeast. On the northwest and the southwest the sea is actively eroding the terrace and the undercut slopes reveal numerous landslides. Landslide catsteps, sags, and ponds are common. On the east the terrace has been undercut by streams, less active than waves, but here too the scarp is steep and subject to landslides. The beach contains black sand and the first attraction of settlement to the region was on the basis of the gold in the sand. At Sullivan's Gulch in the southern part of the landscape, an old beach placer is still to be seen. The placer locations were limited to heavy concentration of black sands plus a water supply for washing the gold. But the gold in the sand is very finely divided and it is difficult to make the placer operations pay even with up-to-date methods and machinery. Two areas of dune sand appear on the landscape, one to the south of the Sixes River floodplain, and the other at the southwest end of an old abandoned channel. Both these dune areas are small but they are advancing slowly onto the upland and in some cases smothering and killing trees.

The feature which distinguishes the various parts of the terraces upland and the other parts of the landscape as well, is the natural vegetation. Although the landscape has been greatly modified by man, there are still remnants of the original forest, grass, and brushy vegetation, although it is difficult to be certain as to the real nature of the original vegetation. In the southeastern part of the landscape the douglas fir is the outstanding plant formation. Much of this is being cut now, and only remnants remain. Near the coast are remnants of the spruce-hemlock forest type although most of the trees are rather stunted. It would appear from local testimony that a large part of the upland at the time of settlement was rather open grassland. Little of this open grassland remains, because of the inroads of various brushy plant formations. The most common of these, wild iris and huckleberry, are gradually destroying the grassland, to the considerable concern of the rancher who grazes his sheep in this area.

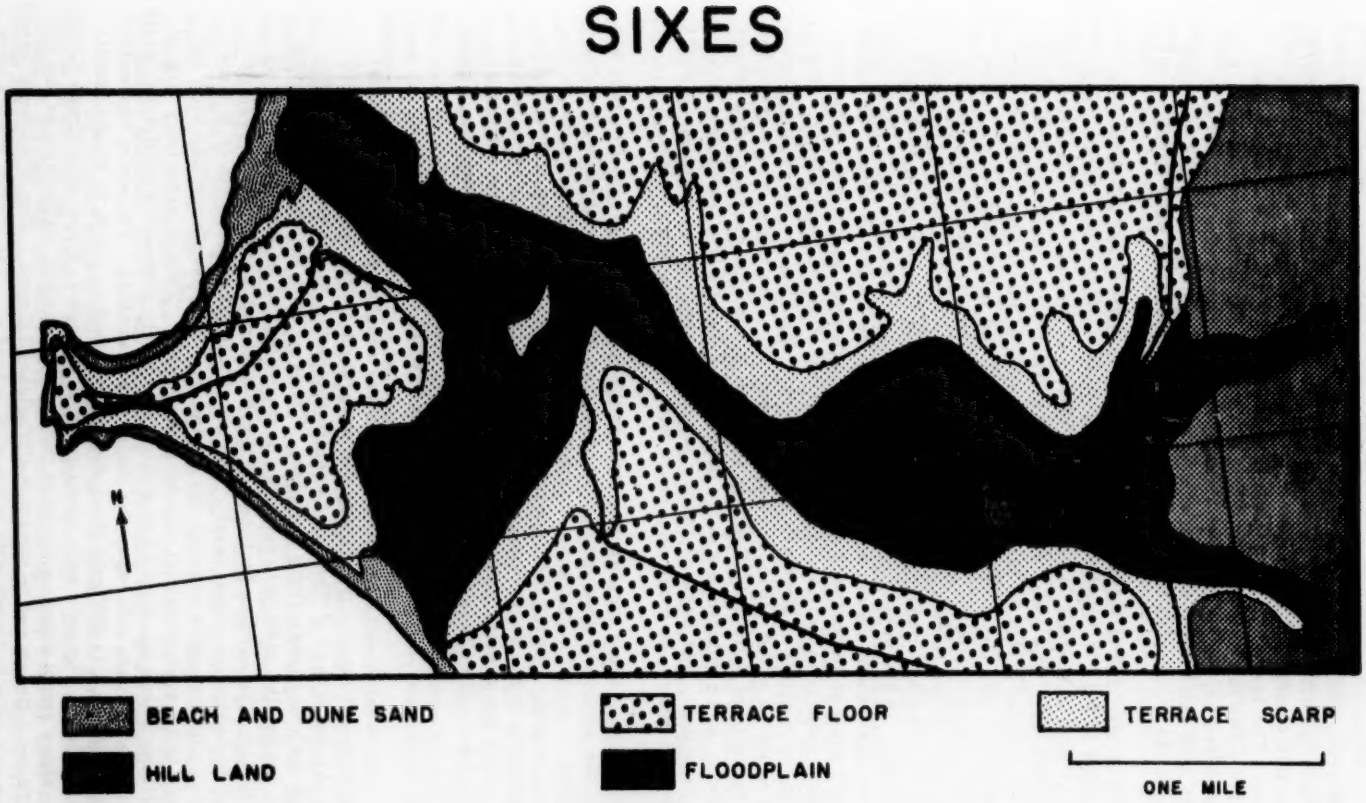

Fig. 5. The Sixes Locality lies along the lower Sixes River in northwestern Curry County. The three major landscapes are the floodplain, the terrace, and the hill land.

The floodplain represents the second landscape of the locality. It varies in width from one-fourth to one-half mile and consists of sands and gravels deposited by the river, some in the form of low stream terraces. Rock outcrops occur on the margins of the floodplain but the river meanders through this floodplain, floods in winter, and reaches a very low stage in summer. The low stage in summer discourages irrigation. The tide ascends the river for slightly more than one mile. The natural vegetation is largely mixed hardwood and coniferous trees with some grassy clearings. Grazing with some cultivation of forage crops is the characteristic land use. One dairy farm occupies the eastern part of the floodplain near Highway 101.

The hill land in the eastern part of the locality rises abruptly from the terrace and the floodplain. Ridge-like spurs between the streams are underlain with sandstone, serpentine, schist, and generally small intrusions of igneous rock. The more resistant rocks stand out in the form of rounded knolls at various points on the crests and slopes of the ridges. Marine terrace remnants are found, especially at the 500 and 1,000 foot levels, often with small gravel deposits. The original vegetation was largely douglas fir but several severe fires and logging have removed much of the saw timber. Partial or complete clearings are used extensively for pasturing sheep and dairy cattle. In the past, beef cattle were driven overland to Port Orford on the south and Bandon on the north where they were loaded on ships. Dairying gradually grew in importance as communications were established with markets, particularly in California. To the northeast of the Cape Blanco Landscape in the vicinity of Denmark and Langlois, dairying is still of importance and, it might be noted, of increasing importance. The miner who worked the beach deposits of Sullivan's Gulch in the Cape Blanco Landscape, soon turned to farming, and established a dairy farm on the Sixes River about one mile above its outlet. The present ranch, owned and operated by a grandson of the former gold miner, is more concerned with sheep than dairy cattle.

Although some logging was done in the locality more than 75 years ago, most of the emphasis upon large cuts of timber has come within the last decade. This is a part of the great migration of the lumber industry into southwestern Oregon. During the summer of 1951 extensive cutting of douglas fir was underway in the southeastern part of the landscape, and at various other places along the coastal plain where good stands were available. Extensive burns in the locality have reduced substantially the amount of standing timber.

THE WHALEHEAD LOCALITY

The Whalehead Locality represents the rougher parts of the coastal area of Curry County. It includes the watershed of Whalehead Creek and part of the watershed of Thomas Creek to the north, and it extends to the crest of the main ridge along the coast. Three or four landscapes are recognizable but for the sake of brevity the description will be confined to the locality level. The surface features of the Whalehead Locality are best described by beginning at sea level. The coast line takes the form of a very steep sea cliff, slightly over 100 feet in height. In most places this cliff is too steep to be scaled without climbing equipment. This is especially true of the sections where the waves are cutting into hard, greywacke sandstone, while in the areas of shale outcrops, the slopes are less steep. The shale represents poor footing and it is difficult along the entire coast to get down to the small beaches below. The only easy route down to the sea is along Whalehead Creek itself. Many small beaches occur at the foot of the cliff, especially at the outlet of Thomas Creek and to the south of Whalehead Creek. The Whalehead beach is about one mile in length with a low cliff behind it. The larger creeks have cut through the cliff and offer access on foot to the upland, but the smaller streams

which flow out to the cliff between the larger ones, have not been able to cut down and in many cases are left as hanging falls well above sea level. The beaches all contain black sand, with gold and chromite, but only Whalehead beach has large quantities. An old beach placer mine still remains at Whalehead, but apparently this operation was never profitable.

Above the cliff in many places lies the remnant of a former terrace. This terrace is narrow, indistinct, and represented only by spur-like remnants. Nevertheless the level, slightly over 100 feet above the sea, is apparent in many places. This may correspond roughly to the marine terrace at Cape Blanco, which is about 200 feet above sea level. Above the first terrace are very steep slopes in most places and a few small benches can be seen at the three hundred foot level. Above 300 feet again there are steep slopes to the 600 foot level. At 600 feet there are a number of terrace remnants to be seen at various places. Some of these benches are several acres in extent and comparatively level and flat. The floor of the 600 foot terrace is nevertheless considerably dissected on its margins by small stream courses. Another distinct level lies at about 800 feet, although this level is not represented by many broad terraces, and it is associated with many isolated flats and level ridge crests. Climbing up 800 feet from the sea, one can travel north or south for perhaps half a mile or more. Above this level again the slopes are steep to the ridge crest, which is 1,200 to 1,500 feet above sea level.

Most of the Whalehead Locality is incorporated in one 5,000 acre sheep ranch. The first settlers who came into the region took donation land claims and attempted field cultivation. As in the Sixes Locality, the first attraction was probably mining. Agriculture is very difficult, both because of the steepness of the slopes and the climatic conditions, as well as poor communications to the markets. Sheep ranching with major emphasis upon the production of wool proved more successful, and the small homesteads were gradually incorporated into the larger holdings.

The vegetation of the Whalehead Locality is somewhat more varied than that of Cape Blanco. The range in elevation is considerably greater, the landscape is more varied in relief and exposure. In general the higher slopes were originally covered with douglas fir forest. Lower down near the sea were scattered remnants of spruce-hemlock formation, with considerable areas of grassland. Whether these grasslands represent burning by the Indians, or a more-or-less natural condition, it is difficult to say. The fact remains, that as in the case of Cape Blanco, recent decades have marked the encroachment of brush upon the grassland, greatly to the annoyance of the rancher, who uses fire, bulldozers, and other devices to keep down the brush.

The sheep are well distributed all over the ranch area and are kept on the ranch without benefit of fences or other hindrances to their migrations. Goats introduced experimentally have not been successful, because of their tendency to wander off the ranch, and perhaps also their greater ability to conceal themselves in the brush. The sheep are rounded up once a year for shearing. Horses, jeeps, and men on foot are used to round up most of the sheep. Some are not found for several years, and consequently yield little wool on the average. Considerable loss of sheep occurs because of the rather numerous predatory animals in the area, including especially bear and cougar.

The brushy vegetation includes huckleberry and manzanita, particularly on the south facing slopes, and various other shrubs. Local testimony is unanimous in stating that the brush has been encroaching very rapidly upon the grass lands and upon the burnt-over and cut-over areas. In the last five years logging has advanced very rapidly, and it is evident that in a few more years very little

saw timber will remain in the vicinity. That the logging of the region was delayed so long is related to the steep and inaccessible nature of the country. Roads must be constructed before the logs can be taken out. The ocean fringes of the Whalehead Locality have been recently purchased by the State of Oregon, with the plan of a possible state park in this area. It is also planned to construct a new highway near the sea, approximately at the 500 to 600 foot level, in order to make a more direct route along the coast, and one with greater scenic attractions. This will greatly add to the recreational use of the region. It is evident that once the standing timber is cut off and this will almost certainly be within the next five years, the chief land use of the region will be grazing and recreation.

THE BROOKINGS LOCALITY

The Brookings Locality lies near the southwest corner of Oregon, on the Chetco River. The main feature of the locality is a broad marine terrace somewhat like that at Cape Blanco, but different in the details of its physical nature and in the land use. The terrace begins somewhat to the northwest of the town of Brookings, carries across the Chetco River and on to the southeast into California. The terrace lies generally above 100 feet near the sea, rising to 175 feet as the foothills are approached. A feature quite distinct is occurrence of numerous old sea stacks of resistant rock rising above the general level of the terrace. A half dozen or so of these old stacks can be distinguished within the city limits of Brookings itself. And numerous others occur, both to the north and to the south of Brookings. As the terrace is traced to the southward, it declines somewhat in elevation, and is not more than 50 feet above sea level in the vicinity of the Winchuck River. The sea margin is represented in most places by cliffs up to 100 feet in height. The coastline is rather irregular in detail, and many small bays have been excavated in the softer rocks by the sea. On the other hand, numerous islands and small stacks stand out from the coast in places. The Chetco River flows into the sea across a gravel bar, which extends a distance of nearly a half mile to the south. One of the small bays in the vicinity of Brookings has been used as a harbor in the past and a wharf was constructed out into the bay. A short line railroad brought logs to this harbor many years ago, but the wharf has not been used for several years. It would be possible to construct a harbor in the lower part of the Chetco River by dredging out the channel and building jettys, but since there is no route to the interior from Brookings, it seems unlikely that this will be undertaken in the near future. The town of Brookings is growvery rapidly due largely to the great increase in lumber production in the vicinity, and also to the importance of the lily bulb industry, particularly to the south.

THE AGNESS LOCALITY

The Agness Locality lies at the confluence of the Illinois and Rogue rivers, in eastern Curry County and represents one of several rather isolated settlements in the province. The Rogue enters this locality from the north and then turns west; the Illinois enters from the southeast. An unpaved road also comes in from the north and ends a few miles southeast of Agness, and a mail boat arrives daily from Gold Beach on the coast. The confluence of the streams has produced two terrace levels, parts of which are cultivated. Above the terraces some of the foothills have been cleared for pasture. These low hills represent the floor of the old valley, rather gentle in slope, which existed before the rejuvenation of the Rogue and the carving of the present canyon.

THE KERBY LOCALITY

The Kerby Locality lies along the Illinois River in southern Josephine County. Three landscapes are present: the floodplain of the Illinois River with bordering terraces; the west slope, underlain in part by serpentine and showing a very thin forest cover; and the east slope with douglas fir forest and the more usual hills. The alluvial plain, partly cleared for cultivation, produces hay and grains. An irrigation ditch hugs the hill land on the west side and most of the floodplain has been leveled to permit gravity irrigation. The town of Kerby, first established on the west side of the river to serve the gold mines, was moved to the east side to be near the through road. It is now a lumber town and has grown very slowly, while Cave Junction two miles to the south has grown very rapidly because of its crossroads location, where thousands of tourists leave the main highway to visit the Oregon Caves.

THE LAKE MOUNTAIN LOCALITY

The Lake Mountain Locality is in southeastern Josephine County, in the higher mountainous district to the east of the Oregon Caves. Elevations range from 4,000 to 6,000 feet. This is entirely in National Forest and has no permanent inhabitants. Division into landscapes is based on the great contrast in the vegetation between north and south slopes. The underlying rocks, mainly granodiorite, have been carved by running water, glaciation, and gravity movements into a series of ridges, spurs, and valleys, with steep knife-edge ridges at the crests, below which are several small cirques, two of which contain lakes. Most of the cirques are on the north side of the main ridge, although one large cirque is on the south slope in the east central section. The dominant forest tree is the douglas fir but some mountain hemlock is found at higher elevations, on north-facing slopes. Greatest contrast is found in the brush and grassy vegetation which has appeared on the burned over slopes. South facing slopes are covered with manzanita and thin grass or small trees, while the north slopes show a luxuriant grass and sedge cover, mixed with a variety of woody shrubs. Because of its remoteness and lack of population the Lake Mountain Locality does not warrant an elaborate study, but it is also clear that a discussion of the province would be incomplete without mention of high altitude landscapes.

THE PHOENIX LOCALITY

The Phoenix Locality lies in Bear Creek Valley a few miles to the southeast of Medford. Three landscapes are present: the foothills on the southwest which include a number of farms -- often called ranches by the natives -- as well as forest land; the alluvial plain, rather intensively cultivated; and the foothills on the northeast, covered with grass and brush and used only for grazing. The town of Phoenix, between the railroad and the highway, was an important stage station in the gold mining days. Its present prosperity depends largely upon pear orchards, forage crops, and livestock. Land holdings are small, although there has been some consolidation in recent years. In the northeast farms are larger and hay covers a greater area than orchards. Almost all the valley floor is irrigated. The hills on the northeast are desiccated by the afternoon sun and support only scrub oak, poison oak, various other shrubs, and some grasses. These hills furnish pasture in the winter, very little in the summer. On the other hand the foothills in the southwest face to the north and are much more humid in appearance. Farms are common and orchards and fields produce without irrigation. The natural vegetation includes douglas fir and oak-madrone forests.

OTHER LOCALITIES

Space will permit only the bare mention of other localities. Grants Pass on the Rogue, near the confluence with the Applegate River, is essentially an urban locality with suburban fringe areas. The town of Grants Pass occupies a strategic position at the point where the main road and railroad leave the Rogue, headed north. Easy routes lead also to the upper Illinois Valley and the upper Applegate. (It is believed that the method outlined above can be applied to urban landscapes as well as rural ones.) Sams Valley to the north of the Rogue in Jackson County is a broad, non-irrigated alluvial plain, surrounded by forested hills. The Mt. McLoughlin Locality represents the younger plateau phase of the Cascade slope while Abbott Creek is in the older dissected portion of the Cascades.

CONCLUSION

The method of regional study outlined above has been partially tested in the field. It provides a flexible hierarchy of "areas" or "regions" which can be integrated into a complete regional study. The first step is the general examination of the province on the basis of the existing literature and field reconnaissance; second, the plan for more intensive study of selected districts, localities, and landscapes. It is obvious that a satisfactory selection of small representative areas cannot be made without a good general knowledge of the province. Clearly, this approach to the study of a region has both advantages and disadvantages. Like most systems it will work better in comparatively simple, homogeneous regions such as the Willamette Valley, than in complex regions such as the Rogue River Country. Where a special technique is needed most, it is most difficult to apply. One of the disadvantages, obviously, is the amount of time needed to study a sufficient number of landscapes and localities and the amount of time or space needed for presentation and publication.

It should be noted, however, that whether this or some similar method is used, all field geographers make observations of comparatively small areas, and then carry on more extensive surveys of larger units. In any event the time has come when field methods and terminology in regional geography should be co-ordinated and standardized in a system which is flexible enough to be used in a variety of regions. The work of the Centennial Studies Committee of the Association of American Geographers (see footnote 1), plus numerous field studies by individual geographers, promises a real advance in methods of regional study.

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THE CHANGING HYDROLOGIC PATTERN OF THE RENTON-SUMNER LOWLAND, WASHINGTON

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One of the earliest regions of farm settlement in the Puget Sound Trough, the Renton-Sumner Lowland, has been an area of historic conflict in the nomenclature of its streams. This situation has developed because of several major changes in the drainage pattern, all of which have occurred in modern times within a relatively limited area.

The lowland is a north-south trending glaciated trough approximately twenty-five miles long and two to three miles wide parallel to the sound and separated from it by a narrow strip of rolling upland. This western upland along and a similar one to the east serve as sharp physiographic boundaries. On the north the valley is terminated by the shore of Lake Washington and in the south it merges with the westward trending Puyallup Valley.

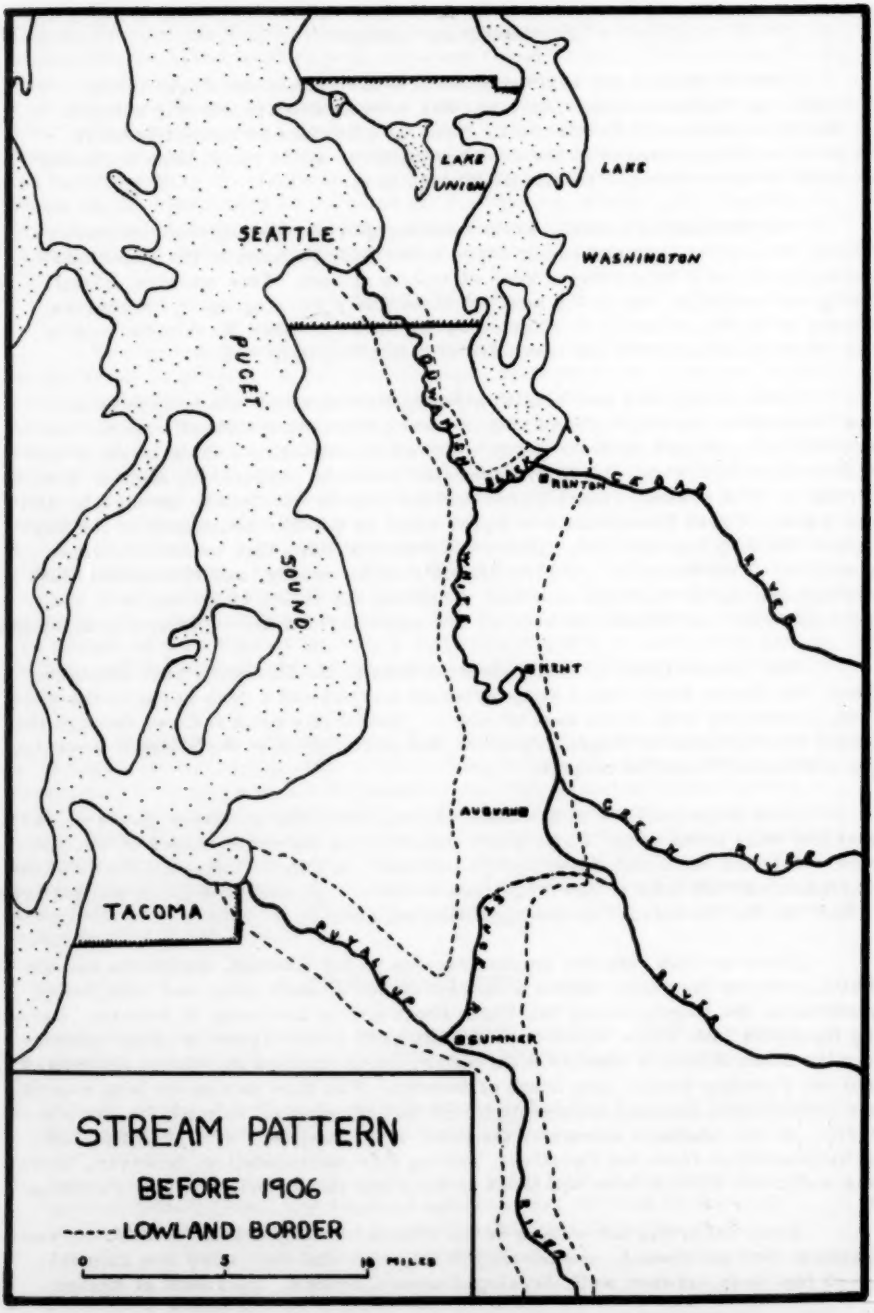
This region is a pre-glacial stream channel which has been deepened and widened by the Puget Sound lobe of the Cordilleran ice sheet. As the ice retreated, lakes and streams fed by melt-water deposited a thick layer of sediments, leaving a wide, flat floor, modified in minor respects by thepost-glacial streams. The present rivers of the lowland include the Cedar, the Green, and the White. Cedar River heads in Cedar Lake on the western slopes of the Cascades, off map 1 to the east. Under natural conditions this would provide a steady flow, but the lake provides Seattle's water supply, and the volume decreases during the summer months. Reaching the valley at its northern end, the Cedar has constructed an alluvial fan which formed the original site of Renton.

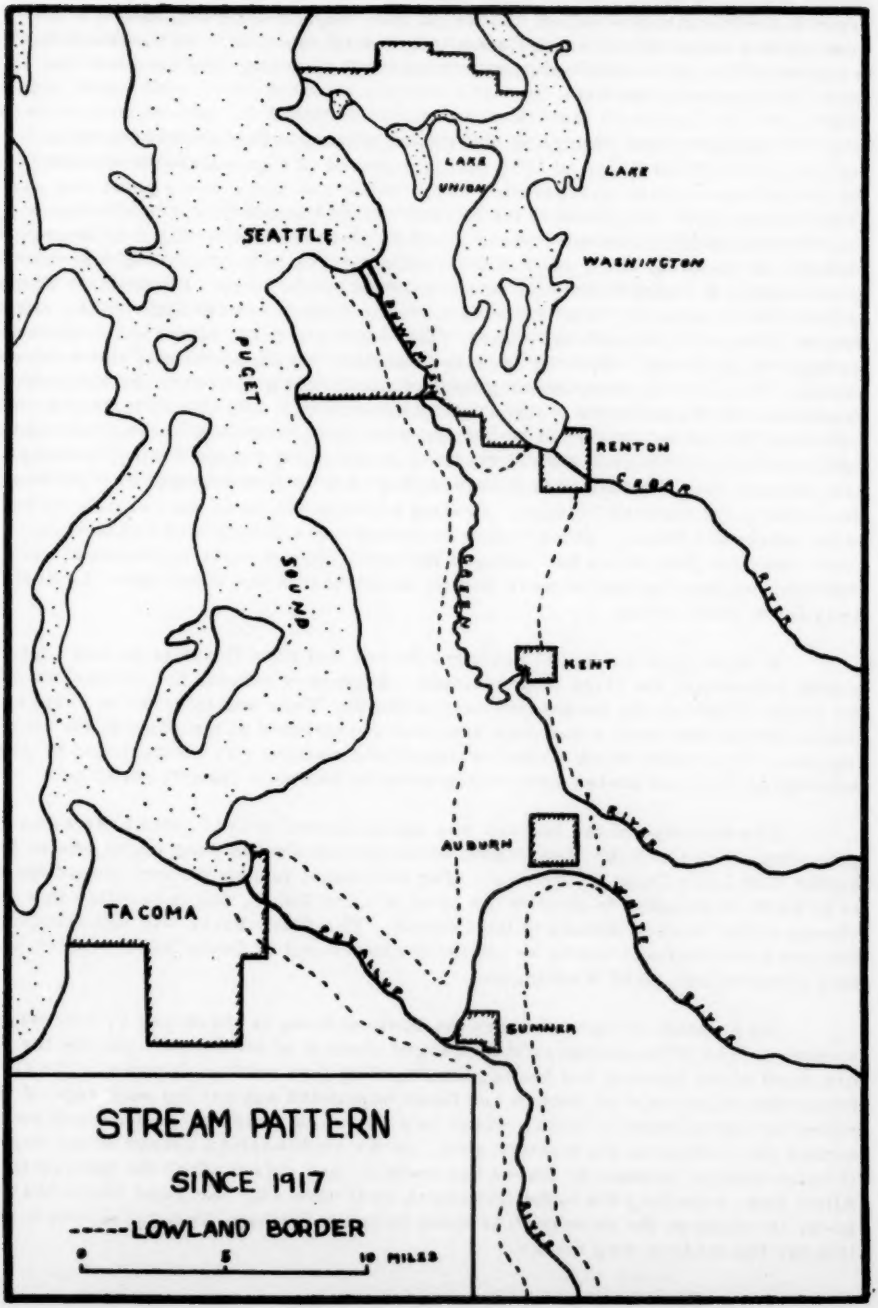
Fed by a number of small streams high in the Cascades near Stampede Pass, the Green River has a steep gradient and has cut a deep gorge in the hard rock formations well to the east of map 1. Below this point it flows through the folded structure of the Puget Group and the glacial drift of the plateau, reaching the lowland northeast of Auburn.

With their sources at Emmons, Frying Pan, and Winthrop glaciers, the east and west forks of the White River converge on the north slopes of Mt. Rainier, while the main tributary, the Greenwater, drains the western flanks of the Cascades well off map 1. The White enters the trough east of Auburn and the town is built on the fan formed by the aggrading stream.

Prior to 1906, the two major streams of the lowland, the Green and the White, entered the valley within a short distance of each other and both flowed northward, the Green joining the White about a mile northeast of Auburn. During floodtime, the White would occasionally spill a small portion of its volume into the Stuck River, a shallow distributary which carried its waters southward into the Puyallup River, just south of Sumner. The flow was never long enough nor in sufficient quantity to develop a well defined channel through the low swampy basin. At the southern extremity the floor of the lowland rises sharply, built up by deposition from the Puyallup. During this sedimentation, however, there was sufficient volume from the Stuck to maintain the opening into the Puyallup.

After receiving the waters of the Green, the augmented White River continued to flow northward, meandering widely over the flat valley in a channel 15-20 feet deep between well developed natural levees. Just west of Renton


LAKE UNION
LAKE WASHINGTON
SEATTLE
PUGET SOUND
RENTON
RIVER
KENT
AUBURN
TACOMA
PUYALLUP
BOUNDARY
BOUNDARY
BOUNDARY


LAKE UNION
LAKE WASHINGTON
SEATTLE
PUGET SOUND
RENTON
CEDAR RIVER
GREEN RIVER
KENT
AUBURN
WHITE RIVER
TACOMA
PUYALLUP RIVER
SUMNER
STREAM PATTERN
SINCE 1917
-----LOWLAND BORDER
0 5 10 MILES

the river cut into the valley side and flowed through a narrow gap to Elliot Bay. At the point where the river left the lowland it was joined by the Black River, a narrow rapid stream which was the outlet for Lake Washington. Its depth varied from a few inches to several feet, regulated by the waters of the lake and the Cedar River which flowed into it from the east. As the Black entered the White, the latter became the Duwamish, carrying this name for the rest of its course to the bay.

The first major change in this drainage pattern occurred on the alluvial fan of the White River in 1906 during a period of high water. Previously the lowest known point of separation of the White and Stuck was a point five and a half miles above the mouth of the Green. From here the two channels were nearly parallel and came very close together just before they began to diverge strongly to the north and south. There had always been a possibility that this narrow strip of land between the streams might be cut away. In the early stages of the 1906 flood most of the White River came down the north channel and water poured through the streets of Auburn. The depth and force of the water increased through the night until the town appeared doomed, and then suddenly the waters abated. The next morning investigation revealed that a drift jam had blocked the channel of the White where it turns sharply northward, away from the Stuck, and the whole volume of water was thrown across the narrow neck of land, sweeping it out completely. The entire stream was turned down the Stuck Valley, cutting a new channel over a thousand feet wide through the fertile farmland and destroying the railway and highway bridges. Feeling between people of the two valleys became extremely bitter. Stuck Valley residents were determined to blast and clear away the dam which had changed the river course while residents of Auburn and neighboring farms were just as insistent that the White River be kept away from their valley.

A legislative act in 1913 allowed Pierce and King Counties to enter into a joint agreement for river improvement. Engineers adopted the channel through the Stuck Valley as the permanent course for the White and in order to assure continued flow to the south a concrete dam was constructed at the point of the original log jam. To mollify Stuck Valley residents the channel was straightened to allow unhindered flow and levees were constructed to increase channel capacity.

The drainage of the lowland was again altered in 1917, this time by an engineering change at Lake Washington which previously had been ten to twelve feet higher than Lake Union to the west. The ship canal joining the two caused the level of Lake Washington to drop to the level of Lake Union, which resulted in a major change in the stream pattern of the lowland. The Black River was left completely dry and a new channel had to be cut for the lower end of Cedar River, which was thus diverted into Lake Washington.

As a result of these changes the lowland today is traversed by two main streams. The White occupies the enlarged channel of the Stuck, draining the southern third of the lowland and joining the Puyallup just south of Sumner. The Green enters the valley east of Auburn and flows northward against the east edge of the valley to a point south of Kent, where in a series of sweeping meanders it swings across the lowland to the western side. In the northwestern corner of the region, it turns sharply westward, leaves the lowland, and cuts through the plateau to Elliot Bay, assuming the name Duwamish as it does so. The point where the Green River is renamed the Duwamish is today purely arbitrary, thus presenting a problem for the modern map maker.

Looking back at the disastrous flood of 1906 and other damaging floods occurring at frequent intervals, the inhabitants of the Renton-Sumner Lowland have a right to be apprehensive concerning high water and other possible changes in the drainage pattern. To alleviate the danger of flood from the White River, Stevens Dam, constructed on the plateau to the east, has served as a successful regulator of flood waters in the southern portion of the valley. The proposed Eagle Gorge Dam would perform a similar task on the Green leaving only a small area around the edge of Renton in danger of occasional flooding from the Cedar. Aside from these flood threats, the hydrologic pattern of the lowland is now presumably permanent.

In the progression of events since 1906, however, two rivers, the Black in the north and the Stuck in the south have disappeared completely from the maps, and two others, the Cedar in the north and the White in the south that formerly swelled the volume of the Duwamish are diverted to other drainage systems. There is little conclusive evidence, as yet, as to changes in river sedimentation. Although the volume of the Duwamish now has been reduced, so has the amount of its load. The construction of the Duwamish Waterway, through deepening and channel improvement, has made comparison difficult. The Green carries less silt than the White, which carries much rock flour from glaciers in its headwaters. This latter load, now carried by the former Stuck channel, discharges into the Puyallup but, again, improvement in the channel of the former Stuck River makes comparisons in sedimentation also difficult.

A PRELIMINARY STUDY OF THE SEASONAL DISTRIBUTION OF PRECIPITATION IN BRITISH COLUMBIA

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The Province of British Columbia extends between latitude 48° 30' and 60° N, and longitude 120° to 139° W. As a result its area exceeds that of Washington, Oregon and California combined. Since it adjoins Washington, Idaho and Montana the major physiographic features of those states continue on into the province although sometimes under different names and often in somewhat different form and of different geological composition.

Thus the Coast Range of Oregon, and the Olympics of Washington, become the Insular Mountains of Vancouver Island, and the Queen Charlottes; the Puget Sound-Willamette lowland becomes drowned leaving the Lower Fraser Valley the only large area of nearly level land in the Province; the Cascade Mountains become British Columbia's Coast Range north of the Fraser River; between the Coast Range and the Rocky Mountains the intermountain region has a great variety of plateaus and mountains dissected by the deep valleys of the major river systems; the Rocky Mountains continue unchanged in name although simpler in form, and features similar to the Foothills and High Plains of Montana are found in the Peace and Liard River Basins of British Columbia.

With such an extent and variety of topography it is not surprising to find a great range of annual precipitation over short distances. Thus the difference between the high totals of the exposed side of the Olympic Range and the comparative aridity of the western part of the Puget Trough is continued in British Columbia. The windward face of the Vancouver Island Mountains receive over 100" (one station, Henderson Lake, has recorded an average annual precipitation of 251.30" in 11 years) while on the leeward slopes in the southeast totals fall to between 28-34". The extreme northern and southern parts of the Interior Plateau, immediately in the lee of the Coast Range, receive less than 12" per annum which drops below 10" in the protected parts of the Middle Fraser and Okanagan Valleys. East of this, totals increase again as the Rockies are approached and the Cariboo and associated mountains of southeastern British Columbia receive in excess of 40" a year and probably larger totals are found over most of the Rocky Mountains themselves.

Many local discrepancies are difficult to account for but the general pattern of the variations is the result of the interplay of the two main controls, topography and the movement of air masses inland from the Pacific Ocean. Although the magnitude of the variations is sometimes surprising the general order is to be expected from a consideration of these two controls. The significance of annual totals of precipitation is comparatively small until something is known of its seasonal distribution and, further, the extent to which it meets the water need.

In order to examine the first of these two requirements a study of the precipitation records of some 130 recording stations was made, (map 1.) the results of which are contained in the remainder of this paper. A preliminary classification of the regimes produced 9 types, (table 1.) the distribution of

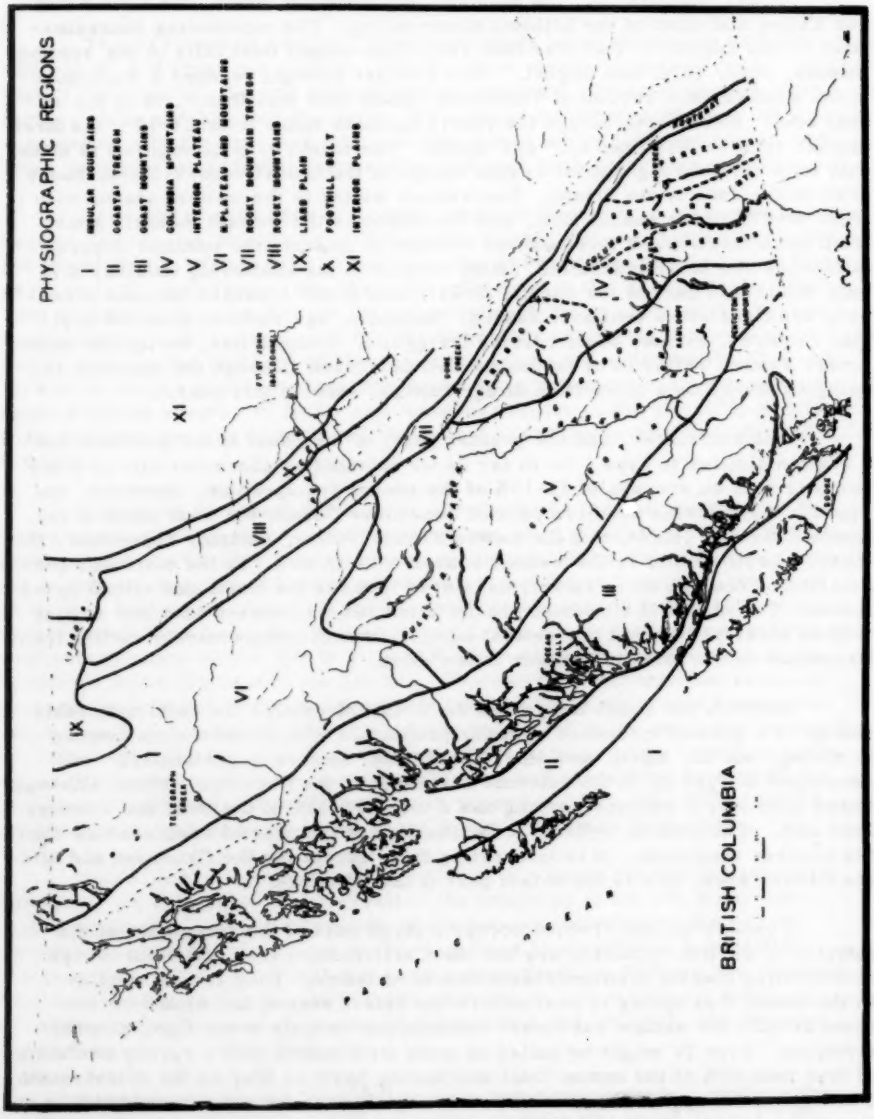
which is shown on map 2. Of necessity most of the boundaries are approximate and, particularly with Types 4, 5, and 6, need further study before being considered final.

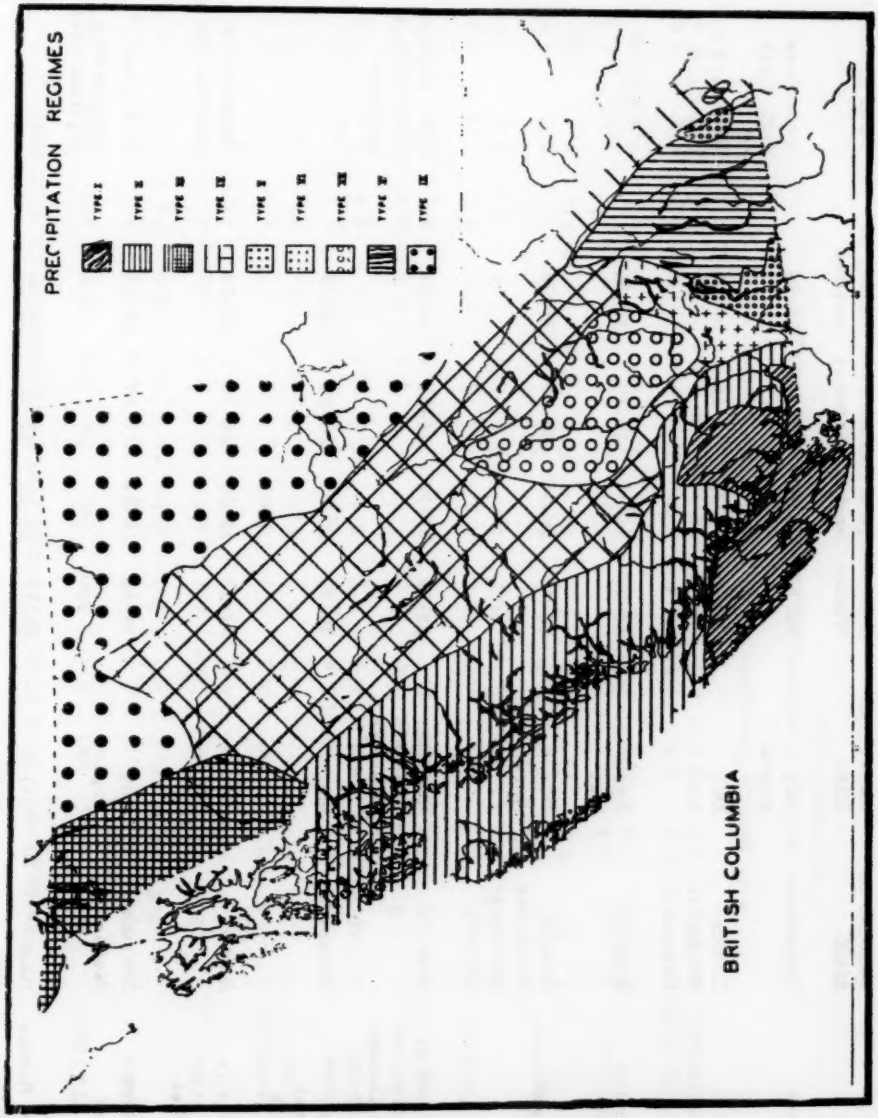
Type I extends over the majority of Vancouver Island, the Lower Fraser Valley and most of the Lillooet River valley. The outstanding characteristic of this regime is that less than 10% of the annual total falls in the summer months, June, July, and August. This summer drought reaches a maximum in the southeastern section of Vancouver Island with less than 7.5% of the annual total. Here, even though the yearly amounts range from 25-70", the three months receive less than 2.5" per month. The month of minimum fall is either July or August throughout the region except in the Goldstream-Victoria-Sooke area where June is the driest. Everywhere winter is the wettest season with from 38-47% of the annual total, and December is the wettest month. Apart from the attractions of this summer climate to tourists the summer dryness influences two basic industries. With respect to the lumbering industry it is only within this part of the coastal forests that forest closures become necessary and fires are a continual hazard. Secondly, agricultural production either requires, or may benefit from, irrigation. Despite this, irrigation in the Lower Fraser Valley is by no means well developed although the situation is being examined by a committee of agricultural experts this year.

The remainder, and the greater part, of the coast of the province has a regime similar to Type I in so far as its outstanding characteristic is a dry summer with an average of 12-15% of the annual precipitation. However, except for the extreme northern part of Vancouver Island, the west coast of the Queen Charlotte Island, and the Lower Fraser Valley, autumn, September, October, and November is the wettest season with 33-40%. In the main this characteristic becomes more clearly developed towards the North and inland up the fiords. The month of minimum precipitation ranges between May and August with no clear pattern but the wettest month becomes progressively earlier from December in the south to October in the north.

Between the Coast Range and the Rocky Mountains the most noticeable change is a greatly increased summer proportion with the minimum coming in spring, March, April, and May. This latter feature is particularly well developed in Type III in the extreme northwest of the Province. Here, although based upon only 2 stations, spring has a mere 11-12% of the total and summer over 26%. The autumn reflects a continuation of the coastal conditions as does the October maximum. It is interesting that, except for the Okanagan and Middle Fraser area, this is the driest part of the Province.

Types IV V, and VI which occupy a large part of the remainder of the Interior of British Columbia are the least satisfactory from the point of view of exhibiting clearly distinguishable characteristics. They are all similar to the extent that spring is everywhere the driest season and winter or autumn usually the wettest but closer examination reveals some significant differences. Type IV might be called an even distribution with a spring minimum of less than 20% of the annual total and having April or May as the driest month. Throughout the region summer has over a quarter of the year's precipitation so that the contrast with the coastal conditions is evident although the influence of the maritime regime remains in the high proportion which falls in winter and autumn. This influence may also be seen in the maximum which is usually in late autumn or winter. In the lee of the Coast Range and in the southern part of the Rocky Mountain Trench the wettest month becomes progressively later from October to December (as on the coast) but north of the Fraser-Nechako


PHYSIOGRAPHIC REGIONS
I INSULAR MOUNTAINS
II COASTAL TROUGH
III COAST MOUNTAINS
IV COLUMBIA MOUNTAINS
V INTERIOR PLATEAU
VI N.PLATEAU AND MOUNTAINS
VII ROCKY MOUNTAIN TRENCH
VIII ROCKY MOUNTAINS
IX LIARD PLAIN
X FOOTHILL BELT
XI INTERIOR PLAINS
BRITISH COLUMBIA


PRECIPITATION REGIMES
BRITISH COLUMBIA

(Table 1) CHARACTERISTICS OF THE 9 PRELIMINARY PRECIPITATION REGIMES OF BRITISH COLUMBIA

TYPE		MONTH OF MAX:	MONTH OF MIN:	Percentage of Annual Total Falling in: Winter	Spring	Summer	Autumn	Total Annual Precipitation	
I	S. W. Coast Summer	December	July August	38	16-23	10	28-34	West Coast S. E. Coast	55-110" 25-55"
II	W. Coast Summer Dry	October November December	May June	30-35	16-22	12-15	33-40	Windward Coast Lee Coast	60-190" 40-60"
III	N. W. Interior Spring Dry	October	April May	24-27	11-12	26-29	35-36		11-14"
IV	Interior Summer High	October November December January	March April	26-32	16-19	25-30	26-30		17-20"
V	Okanagan and Similkameen Even Distribution	June	High Alt: Aug-Sept Mar-April	25-30	19-22	24-26	24-26	S. W. Valleys S. E. Valleys Highland	10-12" 14-16" 18-24"
VI	S. Interior Transitional Winter High	December	Mar-April	30-34	18-21	20-24	24-28		15-20"
VII	S. Central Interior Summer Wet	June	March April	22-27	15-18	29-34	22-25	Protected Valleys Plateaus and North	7-10" 12-16"
VIII	S. E. Interior Winter Wet	December January	July August	34-38	18-21	17-20	26-29	S. Valleys Intermediate Highland over	16-18" 20-30" 40"
IX	N. E. River Basins Summer Wet Winter Dry	June July	March April	16-22	18-23	37-40	22-25		16-17"

(Table II) MONTHLY PRECIPITATION FOR REPRESENTATIVE STATIONS

TYPE	STATION		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot:
I	Sooke	1.	7.2	5.2	4.2	2.4	1.5	1.2	0.7	0.8	2.1	5.3	6.4	8.6	45.4
		2.	15.8	11.4	9.2	5.3	3.3	2.6	1.5	1.7	4.6	11.6	14.1	18.9	100
II	Ocean Falls	1.	18.6	13.1	14.8	10.9	8.1	6.7	6.7	8.4	12.2	21.9	23.0	22.0	166.4
		2.	11.2	7.9	8.9	6.5	4.9	4.0	4.0	5.1	7.3	13.2	13.8	13.2	100
III	Telegraph Creek	1.	1.5	0.9	0.7	0.5	0.3	0.9	1.3	1.7	1.5	2.2	1.1	1.0	13.6
		2.	11.5	6.5	5.3	4.0	2.1	6.7	9.7	12.7	11.2	16.5	8.2	5.6	100
IV	Dome Creek	1.	2.8	1.8	1.7	1.3	2.0	2.6	2.6	2.6	2.8	2.7	2.3	2.5	27.7
		2.	10.2	6.6	6.0	4.6	7.1	9.4	9.4	9.4	10.1	9.6	8.4	9.2	100
V	Penticton Airport	1.	1.0	0.8	0.7	0.8	1.1	1.4	0.9	0.8	0.9	0.9	1.0	1.1	11.4
		2.	8.6	7.1	5.8	6.8	9.9	11.9	7.6	7.4	8.3	8.2	8.5	9.9	100
VI	Malakwa	1.	3.7	2.5	1.9	1.5	1.9	2.4	1.6	1.7	2.5	3.0	2.7	3.8	29.2
		2.	12.8	8.5	6.5	5.2	6.4	8.2	5.6	5.8	8.5	10.4	9.1	13.0	100
VII	Kamloops	1.	0.9	0.7	0.4	0.4	0.9	1.4	1.0	1.1	0.8	0.7	0.9	1.0	10.2
		2.	9.2	6.8	3.7	4.4	9.1	13.7	9.6	10.4	7.3	7.1	8.5	10.2	100
VIII	Howser	1.	3.4	1.7	1.3	1.1	1.5	1.8	0.7	1.5	1.8	1.7	2.0	2.7	21.2
		2.	16.1	7.8	6.3	5.2	7.1	8.7	3.6	7.1	8.4	7.9	9.3	12.5	100
IX	Ft.St. John Baldonnel	1.	0.9	0.8	0.9	0.8	1.7	2.7	2.3	1.6	1.5	1.1	1.2	1.0	16.5
		2.	5.2	5.1	5.2	5.0	10.5	16.1	13.8	9.9	9.2	6.8	7.2	6.0	100

1. Mean Monthly Precipitation in inches.

2. Mean Monthly Precipitation Expressed as a percentage of the Annual Total

Valley a summer month becomes the wettest with only a secondary maximum in winter.

The high proportion of the annual total which falls in summer would appear to supply sufficient moisture for crop needs. However, in the extreme southern parts of the Rocky Mountain Trench and in the protected valleys in the southwest of the region, the yearly total is low enough to have at least one summer month with less than 1" of precipitation. In the Fraser-Nechako-Bulkley valleys -- the 'railway' zone of pioneer farming -- the moisture supply is adequate with 17-20" per annum and generally over 1.5" each month. In fact in those areas with a strongly developed autumn maximum late harvests are often made difficult by excessive rain. The natural vegetation over most of the region is subalpine forest, the protection of which from fire during the summer season requires much expense, despite the apparently wet summers. The fire hazard may become expecially serious early in the summer as the result of the dry spring, and later in the season the hazard still remains since the precipitation is largely convectional, does not saturate the forest litter and, at the same time, brings much lightning.

In the greater part of the Okanagan and Similkameen valleys and the surrounding highlands is an area with one of the most even regimes in the Province. All seasons have between 20-25% of the yearly total but winter is usually the maximum -- although several stations with autumn and even summer maxima are found. In contrast to the winter seasonal maximum, June is everywhere the wettest month which causes the lack of symmetry in the graph illustrating this type. Both the driest month and season are in spring as in Type 4. The three important topographic levels in this area are the valley bottoms, the terraces and the surrounding plateau which, in that order, have an increasing amount of precipitation. The valley bottoms and terraces have the lowest totals in the Province with from 8-12" a year. Thus even the wettest month, June, rarely has more than 1.5" and the other summer months less than 1" which, combined with high temperatures, makes irrigation a necessity. On the higher land annual precipitation ranges between 18-24", the summer proportion of which is sufficient for crop growth although dry years will seriously decrease yields of grain and fodder.

Type VI in the Shuswap Lake and Okanagan Highlands area, is transitional between the winter wet to the east and the more even distribution to the north and south. Here winter is exclusively the wettest season with 30-35% of the annual total and December is the wettest month. The minimum is in spring and the driest month is April except in the southwest where the summer-dry influence of the coast extends over the Cascades and Coast Range to produce a minimum in July or August. This latter area is also considerably drier than the remainder and a natural grassland and parkland vegetation supports an important ranching industry. The seasonal distribution of precipitation is particularly significant to this industry since, in part, it determines the length of time the animals have to be winter fed and the quality of the summer ranges.

Between Kelly Lake and Prince George Airport along the Fraser, and Alexis Creek and Vavenby lies the only area in British Columbia -- other than the Peace and Liard River basins -- with an outstanding summer maximum of precipitation. At least for coast residents this is contrary to the popular conception that all of the interior of the Province has a summer maximum. This Middle Fraser summer wet regime has summer as the wettest season throughout and June as the month of maximum fall. In keeping with most of the remainder of the interior, spring has the lowest totals and April is almost everywhere

the driest month. Annual precipitation ranges between 8-10" in the deep protected valleys but increases to 12-'6" on the plateaus. Here are the natural grassland areas of the Province 'par excellence' with parkland coming in only at the wetter, higher altitudes and towards the north. Despite the summer concentration of precipitation the low totals in the valleys make irrigation necessary for satisfactory yields of most crops. Thus the truck and fruit agriculture of the Lower Cache and the Thompson valleys is heavily irrigated, and the ranchers of the Caribou and Chilcotin Plateaus need additional water for the growth of fodder crops in the valleys.

Type 8, the winter wet regime -- or the 'wet belt' of the interior,-- covers the majority of the Purcell, Selkirk and Monashee mountains and the intervening deep valleys of the Columbia-Kootenay system. This regime shares several features of both the coastal types since, like the southeastern coastal region, it has a seasonal maximum in winter with between 30-40% of the annual total and a December or January monthly maximum and, similar to the remainder of the coast, a dry summer with between 14-18% and a monthly minimum in July or August. It is noticeable that this regime covers both mountains and valleys in the Arrow and Kootenay Lakes district, do-s not include the Rocky Mountain Trench, but re-appears again on the western flanks of the Rockies around Fernie. Even in the valleys annual precipitation exceeds 16", at middle elevations it is between 20-30" and in the highlands over 40". Clearly the regime of the Columbia and Kootenay rivers is influenced by the characteristics of this, their major source and storage region. With generally moist conditions prevailing for most of the year forest covers all but the drier parts of the southern valleys and industry based on this resource is of growing importance. The tendency towards dry summers and the high incidence of lightning storms makes the fire hazard in this area one of the highest in the Province.

Mainly on the lee side of the Rocky Mountains, Type 9 is the most clearly continental of all the regimes. Throughout the region the summer months receive between 35-40% of the annual precipitation and winter usually less than 20%. June and July are everywhere the wettest months and March or April the driest. Northwards in the Liard Basin, on both sides of the Rockies, spring rather than winter becomes the driest season by a few per cent. With the main concentration of population in the Peace River basin and agriculture as their major occupation the relation of the precipitation to plant growth is important. The winter minimum is a mixed blessing in that a small amount of snow may allow longer and more satisfactory outdoor grazing for the cattle but, when accompanied by a dry spring, may provide insufficient moisture for the grain crops during germination. On the other hand heavier snowfall lasting until spring may prevent the farmer from getting on to the land early enough to ensure protection for his crops from the early autumn frosts. The summer concentration of the 16-17" of total precipitation which the area receive - usually sufficient for crop growth during June, July, or August although the neavy convectional rainfall plays an important part in the serious soil erosion problem on the newly planted or summer fallowed fields.

Variety is probably the keynote of the geography of British Columbia, a note which is clearly emphasized in this study of the seasonal distribution of precipitation. In their simplest form the precipitation regimes are the result of maritime control at the coast, the interplay of both maritime and continental influences in the intermountain section and of almost exclusively continental controls in the northeast.

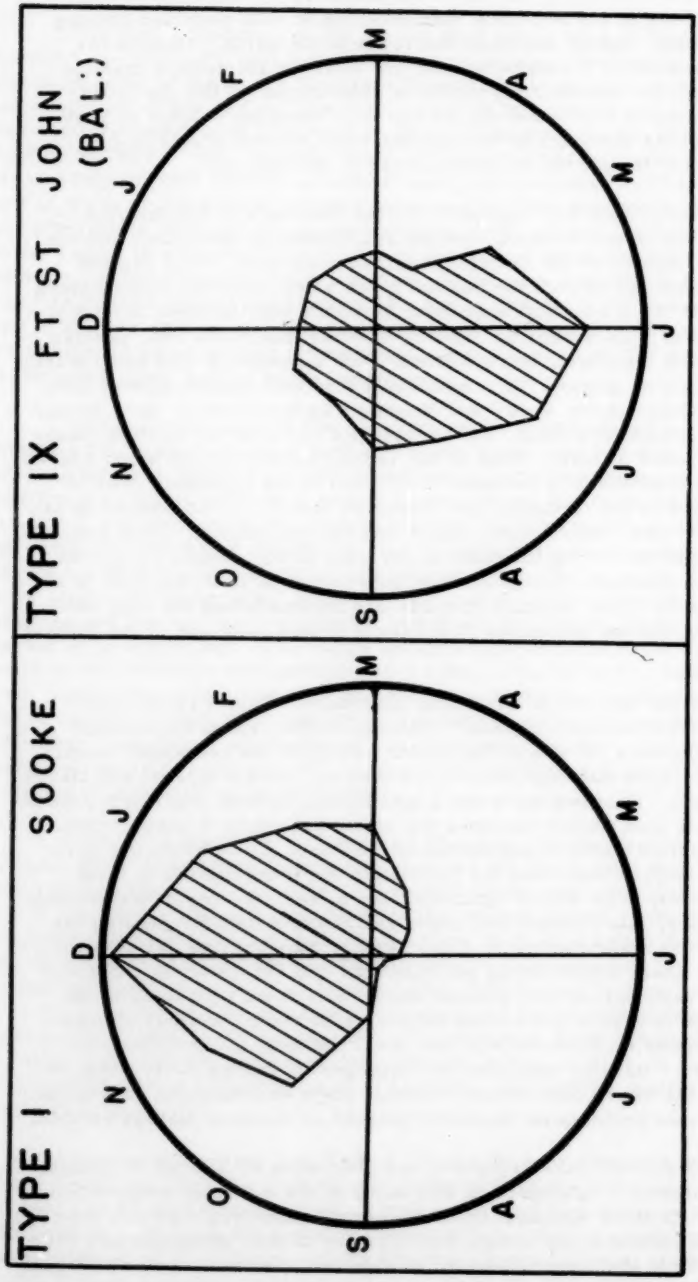


Figure 3. Graphic Representation of the Maritime and Continental Regimes. Monthly Precipitation expressed as a percentage of the Annual Total.

Thus it may be seen that the maritime influence of the southeastern coastal region re-appears, in similar latitudes, in the mountainous southeastern section of the province and leaves its stamp of a winter seasonal maximum in the intervening areas. Similarly the wet winter and autumn of the remainder of the coast extend over much of the intermountain section north of latitude 52 N. In general the outstanding characteristics of this intermountain section are the dry spring, the medium to high summer concentration and the winter or autumn seasonal maximum. Type 7 with its high summer concentration is, of course, the exception. Across the Rocky Mountains the dry winters and wet summers of Type 9 are a clear indication of the dominance of continental influences.

THE HISTORICAL GEOGRAPHY OF THE SALT LAKE CITY MILK SHED

Robert L. Layton

University of Utah

Salt Lake City, Utah, is the center of rapidly expanding grade A milk industry. Always the largest market for fresh milk in the intermountain area, during the past ten years the city has become the processing and distributing center for milk gathered from areas as far as two hundred miles away, and marketed as fresh milk and fresh milk products, over an area extending into Colorado, Idaho, Nevada, and most of Utah. The pattern of this industry, especially as manifest in the distribution of production, is perhaps unique among the milk sheds of the major cities in the United States, and can be understood only in the light of the peculiar cultural and geographic features which control the development of production and marketing of grade A milk.

The Mormon Pioneers who first entered the Salt Lake Valley in July of 1847 found themselves in an environment totally different from that to which they had been accustomed. In contrast to the rolling land of the humid Midwest from which they had recently departed, their new home possessed semi-arid valleys and steep mountains. There was grass green only in the spring, and it made poor hay to support dairy stock through the winter months. There was winter rain and snow but the summers were dry and, without irrigation, crops would not grow. Land level enough to irrigate, and water to turn upon the land, were the two key factors controlling agriculture, and all early settlement chose sites accordingly.

Where suitable land and water were to be found, settlements were made, always following the farm village plan which had been set up by the leaders of the group while they were still in the Midwest. In Salt Lake City, as in succeeding settlements, the people all lived within the settlement, farming the surrounding area. Each family had a town lot large enough to permit a garden, a corral for the family cow, and perhaps an acre of crops. Outside of the city land was distributed according to the occupation of the head of the family, with everyone having some land. Farms were small, with the full time farmers having only fifteen or twenty acres of irrigated land.

Dairy cows were an essential part of this early economy. The first company of Pioneers to enter the valley had brought with them 41 milk cows, and the second company, entering the valley in September of 1847 added 887 to that number. Almost without exception each family crossing the plains by wagon had one or more milk cows, and by 1850 the census listed the dairy cattle population of the Territory at 4,861. As families settled upon the land, they took their cows with them so that the early distribution of milk production coincided roughly with the distribution of human settlement. An excellent picture of the conditions existing in 1860, some 13 years after the city was founded can be obtained from part of a letter written during that year by a Bishop Tuttle of Salt Lake City, to a friend in England. He writes as follows:

> "Almost everyone here has a cow, and all cows get their living free on the waste plains and pastures beyond the Jordon. A herd boy drives them over the river each morning and watches them and brings them back at night. For this he charges three cents per head per day. This morning as I rose, the herd boy,

dinner pail in hand, was driving more than two hundred cows along in front of the Revere House to cross the river."[1]

As the city grew this picture began to change. At first everyone had of necessity been a farmer, or had maintained a large garden, but as Salt Lake became more urbanized there were larger numbers of people who were occupied full time in non-farm positions, and who did not care to spend their spare time farming, or keeping a cow. As this group increased so the market for delivered milk also grew. Those who did have cows, and had a surplus of milk began selling to their neighbors. Extra milk which had formerly been made into butter was now sold as fresh milk, and milk producers just a little further out from the urban center began supplying the butter for the city.

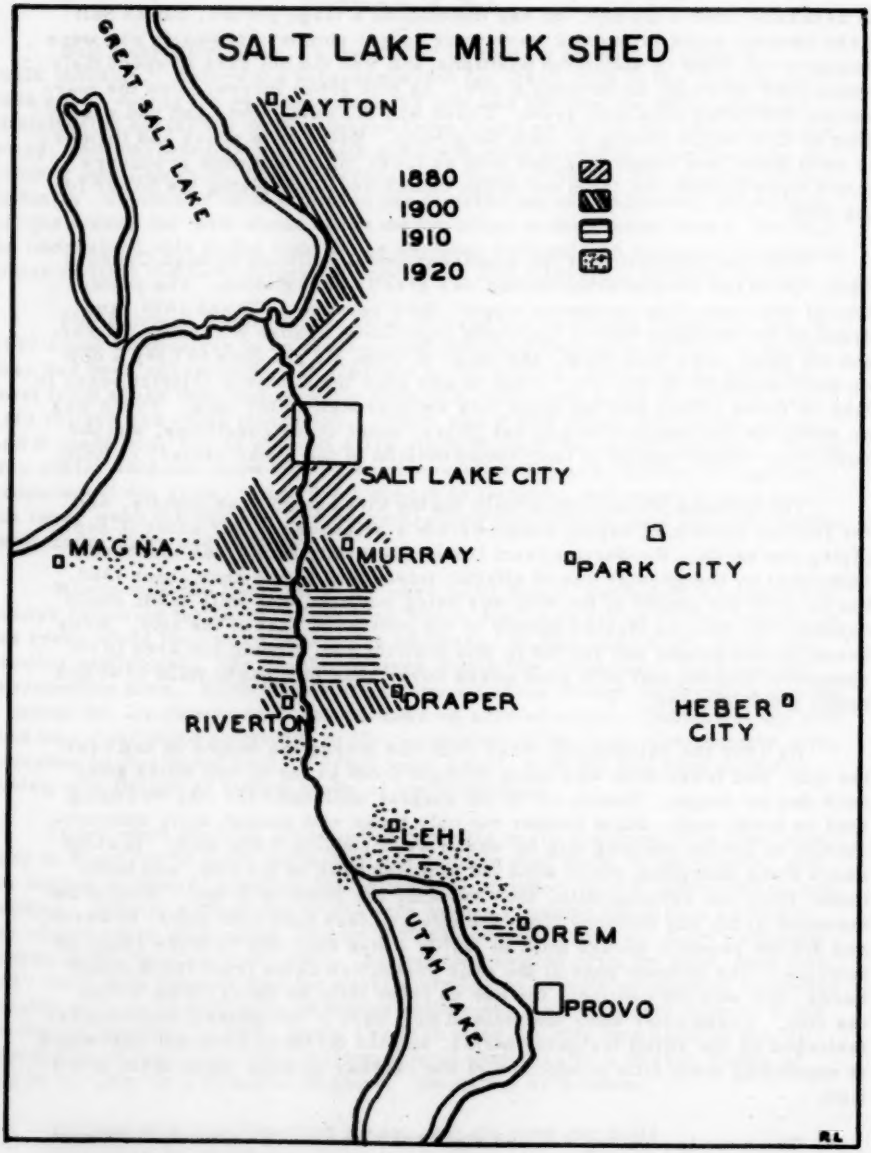
With the completion of the transcontinental railroad through Ogden in 1869, the trend toward urbanization was greatly accentuated. The population of Salt Lake City increased almost 400% between 1870 and 1890, and much of the increase was in non-farm population. Those who came by train did not bring cows with them, and many of them did not care to keep a cow on their property in the city. Land in and near the business district began to take on more value, and the large lots were broken up for sale. There was no room for the family cow and her corral under these conditions, and the cows were either moved to land owned outside of the urban center, or sold.

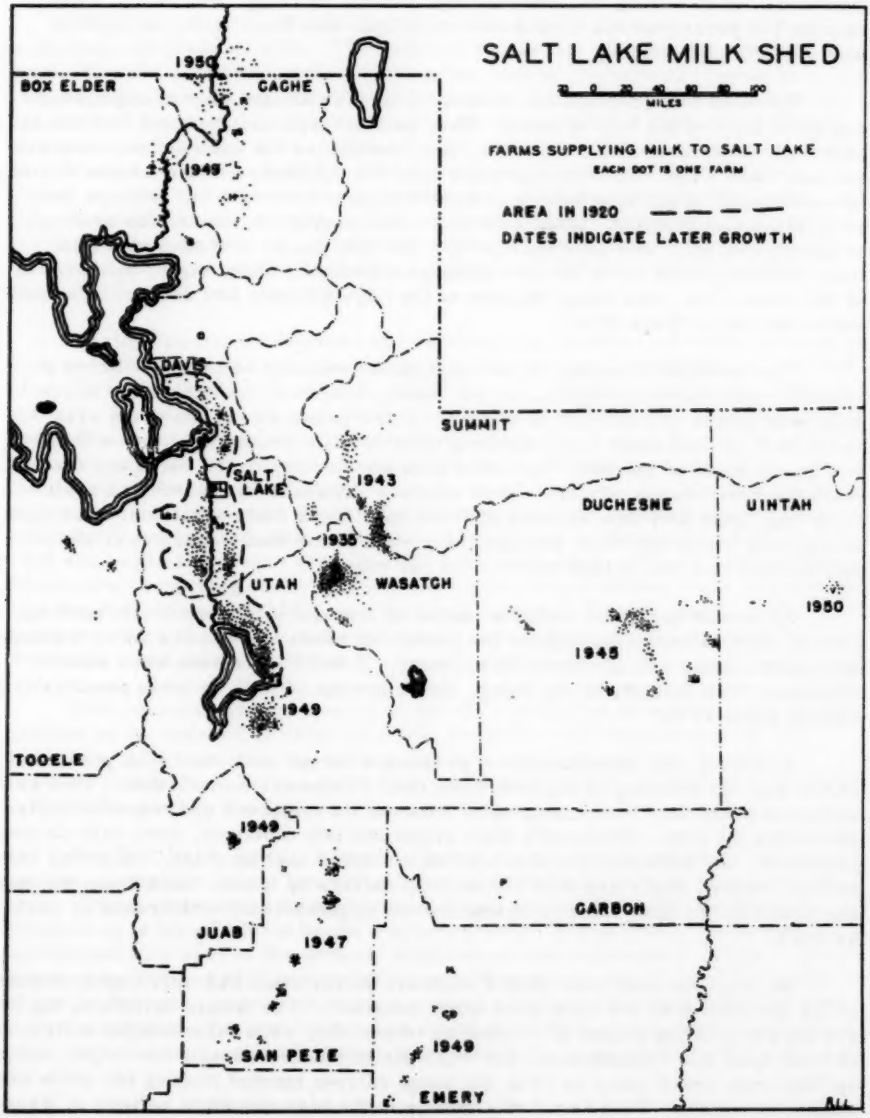
The demand for delivered milk during this period rose rapidly, and the former system of buying surplus from a neighbor fell far short of supplying the needs. Production from the small family herds was increased somewhat by the greater use of alfalfa, introduced in the area about 1860, but by 1870 the center of the city was being supplied with milk from small commercial dairies located mostly in the southeast part of the city. Many Scandinavian people had settled in this district and, finding the area to be somewhat marshy and with good grass cover, had purchased milk cows and begun small dairies.

By 1880 the demand for fresh milk had outrun the supply in and near the city, and fresh milk was being brought from as far as ten miles away each day by wagon. Nearly all of the surplus milk near the city was being sold as fresh milk, while further out only those with enough daily milk production to justify the long trip by wagon were sending fresh milk. In some cases these dairymen would send the morning milk to the city, and make butter from the evening milk, thus avoiding two trips each day. Most of the farmers living any distance from the city had less than four cows, however, and did not produce enough milk to justify a trip each day to make retail deliveries. The greater part of the milk production came from these small herds, and was not available for use as fresh milk by those living within the city. These cows were maintained as a part of the general economy established on the small irrigated farms, and the farmers were not interested in expanding their milk production at the expense of their other farm activities.

The ever increasing demand after 1880 was met by the establishment of larger dairies within the city, and the use by these dairies of wholesale milk pick up routes. By 1890 several dairies within the city were operating wagons which purchased milk wholesale over fixed routes through the territory around the city. This practice enabled the small producer to sell his production as fresh milk. Instead of a trip to the city once a week to sell

1. Neff, A.L. History of Utah. 1940, p. 766.


SALT LAKE MILK SHED
GREAT SALT LAKE
LAYTON
1880
1900
1910
1920
SALT LAKE CITY
MAGNA
MURRAY
PARK CITY
DRAPER
RIVERTON
HEBER CITY
LEHI
OREM
UTAH LAKE
PROVO
RL


SALT LAKE MILK SHED
MILES
FARMS SUPPLYING MILK TO SALT LAKE
EACH DOT IS ONE FARM
AREA IN 1920
DATES INDICATE LATER GROWTH
1950
BOX ELDER
CACHE
1949
DAVIS
SUMMIT
SALT LAKE
1943
DUCHESNE
UINTAH
1935
UTAH
WASATCH
1950
1945
1949
TOOELE
1949
GARBON
JUAB
1947
SAN PETE
1949
EMERY

butter, he now sold his milk from the farm, and at a better price. These milk routes were gradually expanded until around 1900 milk was being hauled by wagon from Layton, a distance of almost twenty miles. This was about the practical limit for wagon hauling of milk. Even though trips in the summer were made during the late evening or early morning, and though some dairies put preservatives such as formaldehyde into their milk, much milk was lost through souring.

To solve this problem the producers located around Layton began sending their milk to the city by train. They built a large cooling plant where they gathered all of their milk, cooled it, and then placed the cans aboard the train for Salt Lake City. At about the same time the producers in the Draper-Riverton area south of the city built a cooler and began sending fresh milk on the train from that district. Even with this added supply, however, the shortage of good fresh milk was such that in 1905 the City Board of Health reported that condensed milk from the new plant at Richmond, Utah, eighty miles north of Salt Lake City, was being shipped to the city, diluted, and sold as fresh milk under the label "Pure Milk".

The northern boundary of the milk shed remained at Layton. North of this city milk moved to Ogden. In the south, however, the area from which milk was gathered continued to expand. A few producers in the dairy area north east of Utah Lake began sending milk by train about 1910, and within a few years much of the milk from this area was moving to the Salt Lake market. With the construction of inter-urban electric railroads both north and south from Salt Lake City new sources of fresh milk were made available. Farmers living near these new lines brought their milk to the station each day, and a special car was run to pick up milk for the city.

As trucks became a reliable means of transportation wholesale pick-up routes were extended throughout the producing areas in southern Davis County, Salt Lake County and northern Utah County. Trucks were soon used also to transport milk directly to the dairy, and shipment of milk by train practically ceased about 1925.

The first real organization of producers on the milk shed took place in 1923, with the forming of the Salt Lake Milk Producers Association. This association acted as a bargaining agent between its members and the retail dairies within the city. Producers were organized into districts, each with its own president, and each district constructed a central cooling plant. Milk was collected, cooled, and shipped to the various dairies by truck. Milk from the cooling plants in the Utah Lake area was moved by glass-lined tank trucks as early as 1925.

By 1931 the Salt Lake Milk Producers Association had over eighty percent of the producers on the milk shed under contract. The larger dairies in the city did not enjoy being placed in a situation where they were dependent for their source of milk upon one organization, and when the producers association began setting up their own retail plant in 1932 the large dairies started looking for some other source of supply. They found this source in the high mountain valleys in Wasatch and Summit Counties over the Wasatch Mountains east of Salt Lake City. Dairying was one of the major industries in these areas and many of the farmers were very happy to shift from selling to the creameries and cheese plants to the higher paying grade A market. As a result of this increased supply of milk to the city prices paid to the producers were held at a low level, and many of the producers who were members of the Salt Lake Milk Producers Association, saddled with assessments for the construction of their new plant, were forced out of the milk

business. The Association as such went out of existence soon after 1938, and was replaced by two new organizations, the Federated Milk Producers Association, and the Hi-Land Dairymen's Association, which control the milk production at the present time.

With the advent of World War Two, Salt Lake City again experienced a shortage of grade A milk. The influx of population both for the employment offered by new industries in the area, and as military personnel in the large military bases established nearby caused a very large increase in the demand for milk. At the same time dairymen found it difficult to obtain equipment and labor. Many of the smaller producers found it easier to obtain work in some war industry than to milk cows, and sold their herds. Added to these and other factors, toward the end of the war the Salt Lake City Board of Health began to enforce more stringent regulations concerning the production of milk. Under the impact of these factors the production of milk in the older established areas actually declined during the period when the demand was expanding.

During the war emergency milk serving the creameries in the area south east of Utah Lake, and those remaining in Summit and Wasatch Counties, was diverted to the fresh milk market, especially for the military bases. After the war, Board of Health regulations forced much of this milk back into the grade C market, but some of the producers remodeled their facilities to conform to grade A requirements and found a ready market for their milk. As the Board of Health cut off some of the wartime sources, the big dairies began to reach out for more grade A production from the outlying areas. Hi-Land Dairymen's Association bought a cooling plant at Roosevelt, Utah in 1945 and began to develop grade A milk from that area. The Federated Milk Producers, supplying the larger dairies in the city, extended their operations into San Pete County in 1947, and Juab and southern Utah County in 1949. Since that time Hi-Land has moved into Emery County, and Federated into Box Elder, and Cache Counties.

With this outward movement of the milk gathering area has come an expansion of the marketing area for retail products. Milk processed in Salt Lake City is now sold as far east as Denver, west into central Nevada and north to Yellowstone Park. Bulk milk is shipped by tank truck both to Denver and to Albuquerque regularly.

The Salt Lake City milk shed of today, measured in volume of milk handled, is double that of ten years ago, but even in this rapid expansion the same patterns have been followed which were present from the beginning. Production is mostly from herds averaging about fifteen cows, which are maintained as a part of the general economy on small irrigated farms. An increase in demand still causes little or no increase in the size of the herds closer to the city, and the demand is met by conversion of established grade C production in some new area to the grade A market, at the expense of the creamery or cheese plant formerly supplied by the milk production within the district.

Progress is being made both in the use of better dairy stock for higher production, and in increasing the size of herds, but it seems most probable that any further increases in the size of the Salt Lake City milk shed for some years to come will follow the same pattern set forth in this paper.

FIORDLAND: NEW ZEALAND'S EMPTY SOUTHWEST

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In the southwestern corner of the South Island of New Zealand lies Fiordland, over 3,000 square miles of rugged, rainsoaked, uninhabited country. The extreme relief, wet climate and character of the rain forest have repelled men so completely that much of interior Fiordland still remains unexplored by Europeans except from the air. No significant resources have been discovered which could draw people to this region in the past for permanent settlement. Today the area is a scenic and wildlife reserve with an extensive undeveloped hydro-electric potential.

Physical Character

Fiordland extends from 44°15' to 46°15' south latitude in the western portion of the district of Southland. It is about 150 miles long and 50 miles wide at the south, narrowing to a point near Big Bay in the north. The region is appropriately named; fourteen steep-walled fiords on its west coast are invaded by the Tasman Sea, and along the fault line which forms its eastern margin a series of glacial lakes constitute "fresh water fiords." Between these crenated boundaries is the large tectonic block that comprises the Fiordland geomorphic region. [1]

Considered as a whole the Fiordland block is a much dissected plateau of crystalline rocks with a general accordance of summit levels. The valleys and fiords which penetrate the area from east and west are narrow and deep with the U-shaped appearance characteristic of heavily glaciated country. The fiords have numerous branches or arms. Drowning of the coast has been so complete that islands occur at the entrance to several of the southern fiord systems. Sutherland sound differs from the other fiords in that it is exceptionally narrow and shallow at its mouth where it is partially blocked by a terminal moraine.

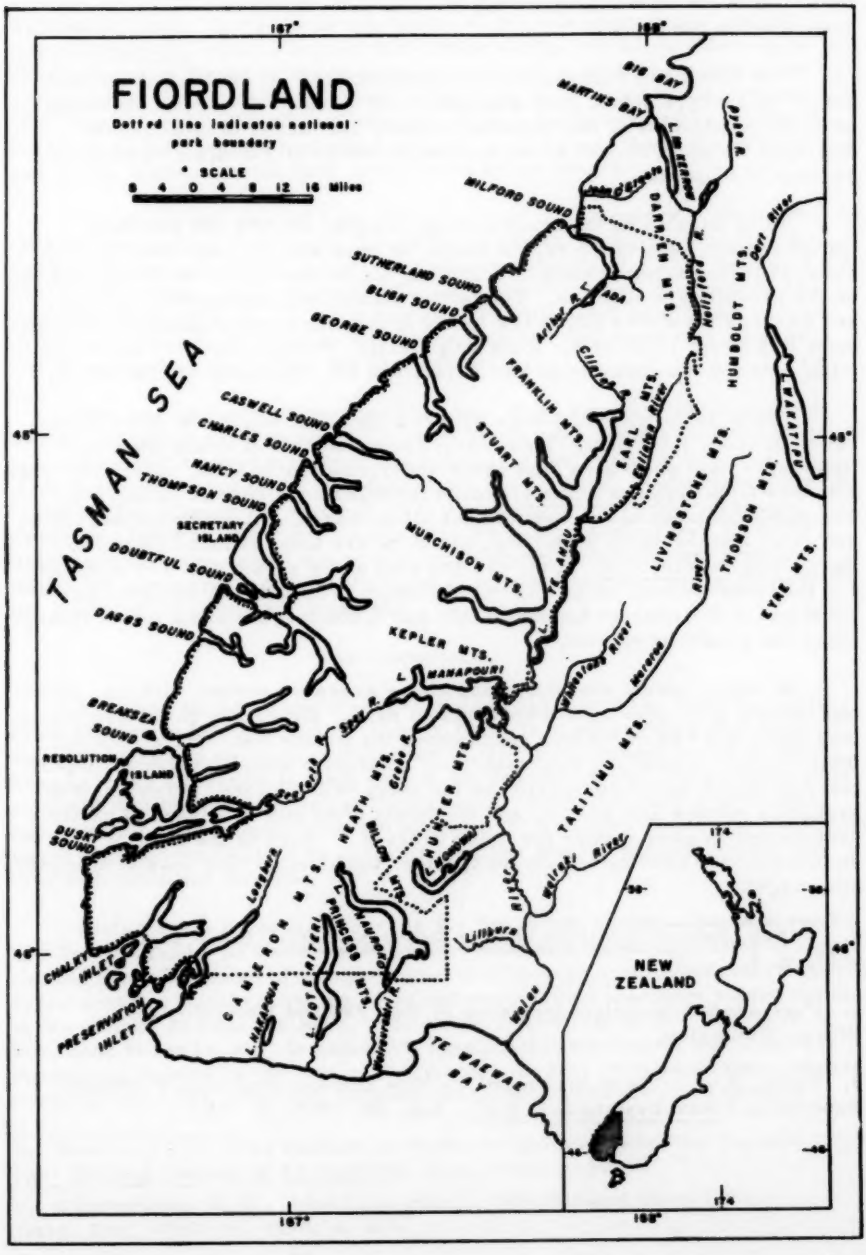
Hanging valleys along the walls of the fiords and main valleys frequently culminate in spectacular waterfalls. Sutherland Falls in the Arthur Valley in northern Fiordland drop 1907 feet. Bowen Falls and Stirling Falls near the head of Milford Sound have less height but discharge directly into the sea. After heavy rains hundreds of temporary waterfalls break over the walls of the glaciated valleys and fiords.

The mountains of Fiordland rise gradually in summit heights from the south to the north, where Mt. Tutoko reaches 9042 feet. This general southward slope of the plateau is in evidence along the coast as well as in the interior, the walls of the northern fiords being higher than those to the south.

The rugged character of the Fiordland mountain block is on display immediately at the sea's edge. On his first voyage in 1770 Cook described Fiordland from the sea as follows:

> "No country upon earth can appear with a more rugged and barren aspect than this doth; from the sea as far inland

1. Cotton, C. A. "Geomorphic Provinces in New Zealand," New Zealand Geographer, Vol. 1, 1945, pp. 40-47.


FIORDLAND
Dotted line indicates national park boundary
SCALE
8 4 0 4 8 12 16 Miles
167°
168°
45°
46°
TASMAN SEA
BIG BAY
MARTINS BAY
L. MCKERROW
DEAS R.
MILFORD SOUND
DARRAN MTS.
SUTHERLAND SOUND
BLIGH SOUND
GEORGE SOUND
ARTHUR R.
ADA
ELLIOTT R.
FRANKLIN MTS.
EARL MTS.
HUMBOLDT MTS.
DORIE RIVER
WAKATIPU
CASWELL SOUND
CHARLES SOUND
NANCY SOUND
THOMPSON SOUND
SECRETARY ISLAND
DOUBTFUL SOUND
STUART MTS.
MURCHISON MTS.
TE ANAU
LIVINGSTONE MTS.
THOMSON MTS.
EYRE MTS.
WAIAU RIVER
DAGGS SOUND
KEPLER MTS.
L. MANAPOURI
WHITESTONE RIVER
BREASEA SOUND
RESOLUTION ISLAND
DUSKY SOUND
HEATH MTS.
CLINTON R.
HUNTER MTS.
TAKITIMU MTS.
MOSSBURN
WILLOW MTS.
HOKONUI MTS.
MILTON
LIVINGSTONE
CHALKY INLET
LORNE R.
CANNON MTS.
POPE RIVER
PRINCESS MTS.
LILLIBURN
PRESERVATION INLET
TE WAEWAE BAY
NEW ZEALAND
174
34°
36°
38°
40°
42°

> as the eye can reach nothing is to be seen but the summits of these rocky mountains, which seem to lay so near one another as not to admit any vallies between them."[2]

Inland the terrain is equally rugged. There is no cultivable land in Fiordland. Deep sea waters prohibit appreciable delta formation where rivers disgorge into the sounds.

The climate of Fiordland is decidedly humid. At the head of Milford Sound the average annual precipitation is 253 inches. At greater elevation near the coast the total fall probably exceeds 300 inches in most years. Puysegur Point lighthouse at the southwest corner of Fiordland records an average of 87 inches.[3]

Rainy days along the coast average between 200 and 250 per year. On the eastern edge of the region Lakes Te Anau and Monowai average only about 45 inches annual rainfall, reflecting the barrier effect of the mountains on the prevailing westerlies. Temperatures are mild throughout the region and whereas snow may fall at low levels in any month the level of permanent snow lies above 7,000 feet. A hanging glacier, the Age Glacier, maintains itself between the summits of Mt. Tutoko and Mt. Madeleine (8,380 feet.).

The mild, humid conditions permit a luxuriant rainforest up to an elevation of about 3,000 feet. This forest cover consists of beech species, Nothofagus, and podocarps with dense undergrowth of bushes, vines and ferns. The tree fern, Cyathea smithii is found throughout the coastal rainforest. The dominant trees in the west are the silver beech, N. menziesii, and southern rata, Metrosideros umbellata, and there are some rimu or red pine, Dacrydium cupressinum. In the eastern part of the region beech is dominant and the forest is less dense and impenetrable. Along the windswept outer coast and in the interior between 2,500 and 3,000 feet the same forest types occur but growth is stunted.

At higher levels sub-alpine and alpine grasses, shrubs, lichens, mosses and several eye-catching flowering plants exist. Especially in eastern Fiordland there is a belt of tussock grass above the timber line. Bare rock and talus breaks out near the mountain tops. Extensive slipping plays an important role in the forest succession on the steep valley slides. Frequent slips prohibit a mature soil profile, and the forest often sits in a layer of partly decomposed organic matter overlying bedrock.[4] Bogs in the interior are sometimes inhabited by bog forest species, but as often they consist of mosses and sedges.

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2. McNab, Robert: Murihiku and the Southern Islands, Invercargill, 1907, p. 9.

3. Precipitation statistics furnished by New Zealand Meterological Office, Wellington.

4. Poole, A. L.: "Brief Account of the New Zealand-American Fiordland Expedition," New Zealand Sci. Rev., Aug. 20, 1949, p. 135.

Fiordland had no native land mammals but the forest contains numerous species of native birds which lend color to the natural scenic resource, and some of which have provided food for the Maori and early occidentals who penetrated Fiordland. Some forest species important as food sources are now reduced in numbers and protected by law. Several of the forest species are flightless birds, including the kiwi, Apteryx species, now a New Zealand symbol. Above the forest line lives the kea or mountain parrot, Nestor notabilis, which allegedly kills many sheep. Opinions differ as to depredations on flocks by the kea but circumstantial evidence points an accusing finger.[5] At present a bounty is paid for keas killed in the pastoral high country east of Fiordland, whereas in Fiordland National Park where the birds breed they are protected by law. At the coast there are various sea birds, some of whom have been hunted by the Maori.

The discovery west of Lake Te Anau in 1948 of a colony of birds belonging to a species previously thought to be extinct reemphasized the relative isolation and primitive nature of interior Fiordland. The "rediscovered" bird is the takahe, Notornis mantelli. Remains of the now presumably extinct moa, Dinornis sp., a large ostrich-like bird, have been found recently in caves in eastern Fiordland, and indications are that there may have been living representatives within the past century.

The marine fauna of the coastal waters of Fiordland afford opportunities for fisheries development. The seal herds were depleted almost to the point of extinction over a century ago and only a few are seen today. The three principal commercial fish caught are the blue cod, Parapercis colias, tarakihi, Dactylopagrus macropterus, and groper, Polyprion oxygenios. Crayfish, Jasus lalandii, are abundant on the outer coast as well as in the fiords and they are caught and prepared for the American export market. Bases for commercial fishing are located outside Fiordland, principally on the coasts of Westland and Southland.

The Occupance

The first known human invaders of Fiordland were the Maoris. Cook found Maoris at Dusky Sound in 1773 but there is scant evidence that they were numerous in any part of Fiordland.[6] The environment seems to have been no more attractive to them than to the Europeans who came later. Cook reported that the few families at Dusky Sound "wandered about a good deal, and were not very friendly with one another."[7] But when Vancouver visited the sound eighteen years later he could find neither Maoris nor indications that they then inhabited the area.

Seals were a seasonal attraction for the rather nomadic tribes of southern New Zealand. At least a part of the temporary Maori population of the fiorded coast consisted of groups in search of pounamu or greenstone (nephrite). In the east the Maoris knew the lakes and some tribes may have hunted the moa in the vicinity of Lake Te Anau. The extent of penetration into the heart of Fiordland is not known. In general it appears that the Maoris made no very significant imprint on the face of Fiordland. All that remains of them today is a legend that a lost tribe still inhabits the fastnesses of the fiord country.

5. Myers, J. F.: "The Relation of Birds to Agriculture in New Zealand," New Zealand Journal of Agriculture, July, 1924, p. 34.

6. Cumberland, K. B.: "Aotearoa Maori: New Zealand about 1780," Geog. Rev., Vol. 39, 1949, p. 419.

7. McNab, op. cit., p. 20.

Occidentals -- Sealing and Whaling

Members of the ship's crew on Cook's second voyage were the first occidentals known to have set foot in Fiordland. The partial charting of Dusky Sound, a favorable report on the harbor it offered, and the mention of seals, by Cook gave the coast some importance for the next half century. In those days a known safe anchorage in the antipodes was of great significance. Captain George Vancouver, who had been a midshipman on Cook's second voyage, visited Dusky Sound in 1791 to carry out ship repairs and cut wood for fuel. Subsequently ships came to the sound to take seals and although the seal supply was soon exhausted at Dusky Sound the sheltering fiords were early adopted as sealing bases for the wild slaughter which took place off southern New Zealand between 1792 and about 1830. As sealing died out whaling increased. The first whaling station in southern New Zealand was established on Preservation Inlet in 1829 and in the beginning whales were taken in the sounds. As these two sea resources were exhausted the importance of Fiordland's natural harbors declined. The emphasis of New Zealand economy shifted to pastoralism and ports were developed where they could better serve their immediate agricultural hinterlands. Thus Fiordland passed through the early period of exploitation virtually untouched except at a few coastal points.

Exploration in Fiordland

The coast of Fiordland was not completely charted until 1851-53. Only small, scattered coastal surveys have been made since.

Most exploration of interior Fiordland has been done from the east, via the lakes. Gold prospectors came early, but except for a little gold mined at Preservation Inlet, their search was fruitless. At one time prospectors beat a path from the mouth of the Waiau River to Preservation Inlet. In 1862 a gold miner named Caples became the first occidental to cross the northern part of the region from Queenstown on Lake Wakatipu to Martins Bay via the Hollyford Valley. Subsequent routes across the rugged Fiordland country have not been numerous. The search for grazing land prompted investigation of the eastern valleys of the region and much of the southern area between the Waiau and Preservation Inlet. In 1887 a crossing was made from the Middle Fiord of Lake Te Anau to Caswell Sound, and a track from the North Fiord of that lake to George Sound was marked and in use by 1900. These two routes are rarely traversed today. Crossings have also been made from the South Fiord of Lake Te Anau to Doubtful Sound and from Lake Manapouri to Dusky and Doubtful Sounds. The discovery of a pass between the headwaters of the Arthur and Clinton Rivers in 1888 by Quinton McKinnon opened up the Milford Track, which has become the most used and most famous foot route across Fiordland. In the same year W. H. Homer discovered Homer Saddle at the head of the Hollyford Valley. A tunnel under this pass is an important link between the Hollyford Valley and Milford Sound on a nearly completed motor road which leads from the Eglinton Valley.

In 1949 the New Zealand-American Fiordland Expedition carried out an ecological survey of about one hundred fifty square miles of land at Caswell Sound and George Sound. A party of surveyors from the New Zealand Lands and Survey Department surveyed about one hundred square miles of country to establish vertical and horizontal control points as a basis for mapping from aerial photographs.

Exotic Fauna

The most striking feature of man's imprint on Fiordland is in the impact of animals introduced into the region by man. There were no indigenous land mammals so that when certain species were introduced by the European colonizers of New Zealand the native flora suffered localized ecological disturbance. Red deer, Cervus elaphus, were liberated at different times beginning in 1898 in the southern lakes area of eastern Fiordland, with the intention of providing big game for hunters. They have since spread to all parts of Fiordland but exist in greatest numbers in the vicinity of the eastern lakes. During the summer they graze chiefly in the higher grassed areas but in winter they do considerable damage to the beech forests through ring-barking, and the eating of beech seedlings and numerous other forest floor plants. Damage is greatest in eastern Fiordland, not only in forest depletion but also in increased soil erosion and flood runoff. For several years government officers have been engaged in destruction of red deer in eastern Fiordland, but their complete extermination is unlikely.

In 1905 a small group of wapiti or elk, Cervus canadensis, were brought to George Sound from Wyoming. Their adjustment to new conditions and the extent of their interbreeding with red deer were the primary motives for the New Zealand -- American Fiordland Expedition of 1949. Fiordland is the only area in the world where red deer and wapiti exist together.[8] Axis deer, Cervus axis, from Saskatchewan were introduced at Dusky Sound in 1908 and they also are believed to have crossed with red deer. Ten moose, Alces machlis, brought to Dusky Sound from Banff, Alberta, in 1910 have reproduced and spread to Preservation Inlet and Lakes Poteriteri and Hauroko but total numbers are still not great and they are rarely seen.[9] Opossums and wild pigs have also been found to cause damage to trees in eastern Fiordland. They are destroyed whenever encountered but are far from controlled. The serious rabbit problem in the hill country of Southland east of the Fiordland lakes has been indirectly responsible for depredations on the bird life in the forest. Various rodents introduced in an attempt to control the rabbit pest have been effective bird killers as they advance into Fiordland.

The red deer appear to have a more adverse effect on the forest than the other species, as they are more widely distributed and occur in greater numbers. Whether or not an ecological balance can be artificially created to provide for the survival of the forest association and the interests of sportsmen at the same time is still in question. Meanwhile Fiordland is a unique region for observation of animal adjustment in a new habitat.

Exploiting the Scenic Resource

Many people have been attracted to Fiordland by the scenery. The eastern valleys and lakes (primarily Lakes Te Anau and Manapouri) have drawn the bulk of tourists, but the west coast fiords are visited by boat and one, Milford Sound, can be reached overland. Fiordland

8. "Operation Fiordland, a New Zealand Expedition," Canadian Geog. Journ., Vol. 41, Oct. 1950, p. 153.

9. Royal Commission Report on the Sheep-Farming Industry of New Zealand, Wellington, 1949, p. 209.

National Park is a wildlife reserve, but the government maintains and improves tourist facilities to provide for public enjoyment of the area.

The outstanding attraction of Fiordland is the Milford Track, which leads from Lake Te Anau to Milford Sound. Its eastern beginning is at Glade House, at the northern end of Lake Te Anau. Glade House may be reached by a launch trip up the lake or by the foot track over Dore Pass from the motor road in Eglinton Valley. From Glade House the track follows the deep valley of the Clinton River to the cirques at its head, climbs over McKinnon Pass and descends into the Arthur River valley, which leads northward to Lake Ada and the head of Milford Sound. Overnight accommodations are provided at Pompolona Huts in the Clinton Valley and Quintin Huts in the Arthur Valley, near Sutherland Falls. Although certain marks of civilization are necessary and inevitable, the track area has been preserved in a remarkably natural state. Over ninety per cent of those who have walked the track are New Zealanders. Tourists from Australia and Great Britain account for most of the remainder. The annual period for maintaining the track extends from about December 1 to April 1, depending on the season.

The motor route to Milford Sound makes the Fiordland country more accessible to tourists. This road follows up the Eglinton Valley into the headwaters of the Hollyford River and passes through a tunnel under Homer Saddle before descending to Milford Sound along the Cleddau River. The Homer Tunnel has not been widened sufficiently to permit two way traffic, and there are several narrow temporary bridges. Maintenance of the road is difficult because of heavy year-round precipitation and numerous winter avalanches.

A possible motor route to the coast is viz. Eglinton Valley and down Hollyford Valley to Lake McKerrow and Martins Bay. Completion of this and a coastal road to the north would connect the glacier area of southern Westland with Fiordland and make it possible for both of these tourist areas to be visited without the present necessity for a circuitous trip of several hundred miles.

Coastal visits to Fiordland are not common. Cruises along the fiorded coast have been organized in past seasons and prior to World War II passenger steamers from Australia sometimes called at one or more of the sounds enroute to Bluff, the port of Southland. Only a few people visit Fiordland by sea.

Tourism is almost the only organized form of resource exploitation in Fiordland. Policy has been to provide enjoyment of the area rather than to realize a profit. Because of its location Fiordland is not visited by foreign tourists so often as some of the northern areas which are not only more accessible but have a longer season of operation. In order to attract and provide for more overseas tourists a costly system of facilities would have to be instituted. Provision of roads, tracks and accommodation facilities has resulted in a minimum disturbance of the natural landscape, thus approaching the ideal character of a national park.

Hydroelectricity

The heavy rainfall and the many deep lake reservoirs suggest the large quantity of electric power which could be developed in Fiordland. There is now only one small power station in eastern Fiordland, below Lake Monowai. This station was opened in 1925 and produces only 6,000 kilowatt hours of power, which is but a small part of the demand in the settled areas of Southland.

One of the more feasible projects for hydroelectric development is based on Lakes Hauroko and Poteriteri. The surface of Lake Hauroko is 515 feet above sea level and Poteriteri is 90 feet above sea level. Near their northern ends these lakes are only about two and one-half miles apart, separated by the Princess Mountains. A tunnel between the two lakes would provide a fall of four hundred feet and an excellent source of power. The hydroelectric potential of such a project has been estimated at 100,000 kilowatts. The location is less than one hundred miles from Invercargill, the nearest city, and only thirty-five miles from the nearest electric transmission line. Although there are no roads to these lakes the building of roads for transport of equipment and supplies into the construction and tunneling sites would present no great difficulties. Alternative possibilities for development of these lakes are a project linking Lake Hauroko to Te Wae Wae Bay with a potential of 77,000 kilowatts and a generating plant on the Waitutu River below Lake Poteriteri with an estimated output of 25,000 kilowatts.[10]

Lakes Te Anau and Manapouri are even larger natural reservoirs. They are drained by the Waiau River, which makes its way to the sea through the western part of occupied Southland. There are several possibilities for dams and power stations on the Waiau but in most cases they involve flooding pastoral land. Other proposals for utilizing the lakes involve tunnels which would carry the water through the mountains to one of the fiords. One project of this nature would connect the west arm of Lake Manapouri with the easternmost extension of Doubtful Sound and produce 208,000 kilowatts of power. A similar scheme connecting the Middle Fiord of Lake Te Anau with George Sound would have an estimated output of 572,000 kilowatts. Numerous small power schemes could be built at the heads of fiords, but at present they would not be economically practical.

The hydroelectric potential of Fiordland has not been ignored, but neither has it been developed. New Zealand Sounds Hydro-Electric Concessions, Ltd., was formed in 1926 to exploit the wāterpower resources of Fiordland. Financial backing from sources in England was arranged but changes in the New Zealand government and the worldwide depression in the 1930's put an end to this ambitious venture. Subsequent exploratory work has so far not resulted in any positive developments. The paucity of population in southwestern New Zealand and the relative absence of manufacturing industries in the settled areas have been negative factors holding back development in spite of the existing power shortage throughout New Zealand. The need for nitrates in the agricultural economy of the country and the feasibility of refining light metals with electric power suggest two major outlets for hydroelectric output.

10. Power estimates furnished by State Hydroelectric Department, Wellington.

Conclusion

The fiorded coast of New Zealand bears a physical analogy to its counterparts in Chile, British Columbia and Norway. But in contrast to those regions it is virtually unsettled and undeveloped. New Zealand's economy has been overwhelmingly pastoral, and Fiordland has offered no opportunities for expansion either in agriculture or commercial forestry. Known mineral resources are negligible. The assets are scenery and a hydroelectric potential. The maintenance of Fiordland as a national park reserve is undoubtedly the best land use policy for the region. It is conceivable that the water power resources of the region can be exploited without impairing the value of the scenic resource.

Fiordland presents a challenge to New Zealand. Extensive settlement may not be necessary for effective use of this "empty southwest" but care will have to be exercised if the mistakes made in primitive areas elsewhere are not repeated here.

THE ASSOCIATION OF PACIFIC COAST GEOGRAPHERS

Fifteenth Annual Meeting

Corvallis, Oregon, June 19 - 21, 1952.

The fifteenth annual meeting of the Association was held at the Oregon State Agricultural College, Corvallis, in connection with the annual meeting of the Pacific Division, American Association for the Advancement of Science. Four half-day meetings were devoted to the presentation of papers, and a full day field excursion occupied the final day. A business meeting was held on the morning of June 20. The address of the retiring president was given at the annual dinner meeting on the evening of June 20.

Program, with Abstracts of Papers Presented.

(Papers published in full in this issue are not abstracted)

THURSDAY MORNING SESSION, JUNE 19.

The Livelihood Structure of Salem, Oregon. NORMAN T. MARCH, University of Oregon.

Abstract: Salem, Oregon, is a city of 43,000 persons in 1950. It is situated largely on the alluvial flood plain on the east bank of the Willamette River, 50 miles southwest of Portland. The livelihood structure of Salem is based upon five major industries, providing employment for 87% of the total employed population. These industries and their employment percentages are: service industries, 25%; retail and wholesale trade, 25%; manufacturing, 15%; public administration, 13%; and construction, 9%. By comparison with other American cities of comparable size employment in trade, service, and construction industries is average; is low in manufacturing, and is unusually high in public administration.

The pattern of specialized functional districts in Salem is complex. This is owing largely to the lack of any systematic zoning program and the annexation of several small communities having previously developed localization. The bulk of retail, wholesale and service activities are carried on in the central business district, occupying an area of about 30 city blocks near the center of the built-up area. Manufacturing is concentrated in four major districts, predominantly on the fringes of the city. Public administration activities are localized chiefly in the Capitol district, on the eastern margin of the central business district, and other government activities are concentrated in a strip along the eastern city limits. Construction livelihood has no apparent concentration but is confined largely to areas of relatively cheap land. Residential districts occupy the area north, east and south of the central business district with a major outlier across the Willamette River in West Salem.

Measuring the Significance of Primary Employment. WILLIAM L. GARRISON, University of Washington.

Abstract: The problem in evaluating primary employment has two aspects: (1) the significance of primary employment in total employment; and (2) primary employment as indicative of primary economic activity. The latter aspect is presented here. A review of the literature suggests: (1) studies of primary employment are chiefly restricted to studies of manufacturing employment; (2) studies are made of employment without determining what is measured other than employment; and (3) the comparative bases used in the studies are so broad that detail conclusions are often obscured or fallacious.

In developing a technique of employment measure manufacturing employment as a criterion of the significance of manufacturing is recognized. Correlations between manufacturing employment and value added by manufacturing are shown to be very high. A formula was presented for the computation of coefficients of manufacturing employment. In this formula, the number of workers employed in a given place and the population of the place are compared with the same criteria in a universe of like places. For example, the significance of manufacturing in a large city is determined by comparing that city to a universe of large cities. It is argued that it is unwise to use a single criterion for determining the significance of manufacturing in heterogeneous areas. An examination is made of the areal arrangement of manufacturing in the United States and coefficients of manufacturing over an eighteen year period are compared.

Urban Regions as Indicated by Newspaper Circulation. JOHN W. GIERHART, University of Washington.

Abstract: Detailed information regarding areal circulation of newspapers is not available. This paper is an attempt to evaluate the extent of urban regions as indicated by using the data that is available, specifically, the circulation of daily newspapers, by county, for the state of Washington. It is possible thus to indicate the approximate intensity and limits of major metropolitan nodal centers, but this data is not sensitive enough for use with local centers.

The Razor Clam Fishery of the Washington Coast. CLARKE H. BROOKE, JR., University of Nebraska.

Abstract: Along the beaches of southwestern Washington are found rich beds of the razor clam, Siliqua patula, which are important in the economy of the beach communities by reason of: sales of the raw clams to commercial diggers; wages paid to employees of razor clam canneries; income derived by beach community residents serving thousands of tourists who visit the beaches to dig clams.

Since World War II, the status of the canning industry has become uncertain owing principally to two factors: (1) the rapid growth of the Washington crab industry, which uses razor clams as bait and has taken up to eighty per cent of the commercial landings of raw clams, and (2) the greatly intensified recreational fishery. Both uses have depleted the stocks of mature clams,

have forced the State Department of Fisheries to close two of the three major razor clam beaches to commercial digging, and have caused reduction in the limit of the recreational catch. These actions have aroused the opposition of the commercial diggers, canners and crab bait buyers, and the resort owners. The future of the razor clam fishery of Washington is uncertain. More study is needed to determine the optimum intensity of the fishery. The effects of heavy digging have depleted the stocks many times in the past. Yet, when intensity is relaxed, the clams have recuperated rapidly.

Natural Grasslands on Sunward Slopes. JOHN E. SMITH, Oregon State College.

Abstract: In the timbered areas of mid-latitudes both north and south, natural grassy slopes, inclination 16° to 26°, are found on the sunward sides of hills, bluffs and ranges. They are on the southwest and south sides in the northern hemisphere, and on the northwest and north slopes south of the equator. These are confidently believed to be caused by the action of the vertical and nearly vertical sun which shines on them several hours daily during a part of the summer season when the sun is vertical on and near the tropics respectively. The amount of heat received prohibits the survival of young trees but is insufficient to produce desert conditions. The space can be occupied only by plants that are able to pass this season during a dormant period in their life history -- hence the grassy cover. These areas are essentially spots of modified Mediterranean climate. They are natural grasslands and have never been covered with forest. This information is useful in landscape architecture and in agriculture, aiding in the possible introduction of Mediterranean vegetation; e.g., cork, almond, fig and other trees and decorative shrubs, and in selecting fields and garden spots having earlier seasonal maturity than nearby vicinities.

A Photographic Interpretation of Arctic Alaska. WOODROW R. CLEVINGER, University of Washington.

Abstract: Practically complete aerial photographic coverage has been obtained since 1946 of all Alaskan lands above the Arctic Circle. Photogrammetric coverage of vertical views at 1:20,000 scale and oblique views have been turned over to the U.S. Geological Survey by Naval and Air Force aerial reconnaissance units. A photographic interpretation enables analysis of two vast North American physiographic provinces in part inaccessible to ground study.

The Arctic Coastal Plain reveals a unity of rolling tundra, gently warped by crustal activity and punctuated monotonously with almond shaped ponds and lakes resulting from summer melting of a deep layer of permanently frozen ground. The plain's deep Quaternary beds of clay, and sand are cut by north flowing, summer-thaw flash rivers. The river plains have vegetation contrasting greatly with tundra uplands; willows and other rooted shrubs appear to have moved north along the streams as invaders into an otherwise treeless tundra plain.

The Brooks Range Province is a 5,000 to 9,000 foot barrier isolating Alaska's great Arctic plain. A post glacially eroded and semi-arid sedimentary plateau, it appears impassable for movements of animals or plants

except in its few deeply intrenched north-south passes and gaps such as the Anatuvuk - John River pass. Arctic Alaska as revealed in its aerial mosaic portrait is predominantly a primeval landscape - an Urlandschaft relatively undisturbed by man. Human activity has modified only a few square miles such as the villages and installations on the coastal sandspits at Barrow and Barter Island, and the tractor-sledge trails leading from Barrow to a few oil exploration camps in the interior of the plain.

Some Factors Influencing the Extent of Retail Trade Domination Between Seattle and Everett, Washington. DOUGLAS B. CARTER AND FRANCIS W. ANDERSON, University of Washington. No abstract received.

The Farallones: California's Isles of Mystery. CURTIS M. WILSON, University of Toledo. No abstract received.

THURSDAY AFTERNOON SESSION, JUNE 19

The Washington State Resources Project. OTIS W. FREEMAN, Eastern Washington College of Education. No abstract received.

The Changing Hydrologic Pattern of the Renton-Sumner Lowland, Washington. JOHN O. DART, Portland State College. Published in full in this issue.

The Historical Geography of the Salt Lake Milk Shed. ROBERT L. LAYTON, University of Utah. Published in full in this issue.

Metropolitan Affinities of the Middle Shenango Valley Towns, CLYDE E. BROWNING, University of Washington.

Abstract: The causes and consequences of metropolitan affinities between urban centers has been largely neglected by geographers and social scientists. The factors having the most obvious influence on mass attraction of a large metropolitan area upon a smaller town are proximity, accessibility, and size. Factors of a second order influencing the degree of affinity are not as easily measured and their influence may vary from complete absence to roles of special importance. They include: cultural links, urban functions, local enterprise, state boundaries, business affiliations, income level, and suburban residence.

The four towns of the Middle Shenango Valley, on the Ohio-Pennsylvania border, have been subjected to the usual mass attraction of not one, but actually three metropolii, Youngstown, Pittsburgh, and Cleveland. Of the three, Youngstown exerts the most influence because of proximity. Pittsburgh, despite the fact it is slightly farther away and less accessible in terms of traffic congestion, has a greater influence than Cleveland primarily because of similar state interests.

Sequent Occupance in the Roseborg District. ROBERT A. HARTLEY, University of Oregon.

Abstract: The Roseburg District has exhibited three phases of occupance. These are: (1) primitive subsistence, (2) agricultural, and (3) commercial forestry. The district is a trough-like basin in southwestern Oregon. The surrounding heavily forested hills and mountains give the district an almost insular position. Level, but not extensive valley lowlands provide suitable areas for agriculture and favorable sites for the economic activities of the district.

The primitive subsistence phase was characterized by small bands of Umpqua Indians occupying temporary village sites and subsisting on an economy of fishing, hunting, and gathering. Their culture involved no significant alteration of the physical environment. This phase ended in 1853 with the removal of the Indians to reservations. The agricultural phase, characterized by the utilization of favorable valley lands for farming, was dominant in the district until 1940. The present dominance of commercail forestry is the result of a depletion of more accessible timber tracts in other areas, and the increased demand for lumber with associated higher prices due to World War II.

The three phases of occupance in the Roseburg District are facets in the total pattern. The form and function of each phase has contributed to the development of subsequent phases while at the same time possessing enough individual character to be classified as a separate phase. The present pattern of occupance is a progressive outgrowth of all three phases.

Recent Land Forms on the Mexican Highlands of the Basin and Range Type. R. B. PETERS, Laguna Beach, California.

Abstract: An Extensive maturing volcanic and land surface surrounds Lake Chapala, together with what are thought to be three Pleistocene Basin and Range type blocks tilted up along fault line scarps to from 3,000 to 5,000 feet, with apparently little drop on the downthrow side. The back slopes seem to be only partially eroded, remnants of the original land surface. These blocks are at the edge of the great Pleistocene lava flows crossing Mexico from the Atlantic to the Pacific. The trellis drainage system of the highland is seemingly related to but subsequent to the breaking up of the highland into great angular blocks, possibly related to horizontal movements. Canyons have been cut to a depth of around five thousand feet. Certain nick points suggest a fairly recent rejuvenation.

Oregon's Climate, A Rational Classification. EDWARD J. JONES, JR., University of Oregon.

Abstract: The diversity of Oregon's climate provides a laboratory for a worthy test of the Thornthwaite classification of climates. Four maps of Oregon were drawn depicting the areal distribution of the moisture factor, the heat factor, and the seasonal variation of the two. Moisture regions show great diversity, extending from perihumid types to arid types. The seasonal variation of effective moisture also exhibits a similar range in variety.

including areas with no seasonal deficiency and also areas with no seasonal surplus. Thermal efficiency regions are limited to two mesothermal and two microthermal types. Summer concentration of thermal efficiency shows abnormal distribution owing to maritime influence. This classification is successful in portraying the areal distribution of climate in Oregon as it is known through human experience and observation. Further study of this classification and its application to Oregon's climate may lead to a better understanding of the geography of that state.

The Historical Geography of Tooele, 1847 - 1870. RICHARD G. SALTER, University of Utah.

Abstract: Tooele City, Utah, was formerly a typical Mormon settlement with a marked degree of religious, economic and political unity. It took about 15 years for outsiders to break down this closely knit community. The early emphasis upon agriculture was strong since Tooele was an isolated settlement encircled by a desert environment. These people spent their entire time improving their farms and farming operations so as to insure a sustaining crop yield.

In the period 1847-1870, Tooele passed through the stages of agricultural exploitation, isolated settlement with cultural unity, mining booms, and finally into close economic ties with Salt Lake City with the advent of the transcontinental railroad. The arid landscape which resisted the efforts of the Mormon pioneers has furnished the Federal Government with one of its major proving grounds for chemical and desert warfare since World War II. Tooele's recent growth is the result of this Government spending as well as its agricultural and mining activities.

Currents of the North Pacific. HAZEL R. NEWHOUSE, Portland Extension Center.

Abstract: The glass floats from Japanese fish nets on the sands of the beaches of the Pacific Coast call attention to the means by which they were conveyed across the ocean. The Kuro Siwo was distinguished and named by the Japanese ages ago. This stream is a portion of the great equatorial current of the North Pacific and the name is given to the portion from Formosa to about 35 degrees N. latitude; Kuro Siwo Extension to about 160 degrees E. longitude; North Pacific Current to about 150 degrees W. longitude; California to the section along the coast of North America until it merges again with the equatorial current. Although many credit the mildness of the Pacific Northwest to the Japan Current, it seems that its relatively small size compared to the vastness of the whole Pacific Ocean would indicate that most of the credit should go to the westerlies blowing over the great Pacific to the west.

Paleo-Pedology and the History of Lake Bonneville. VASYL GVOSDETSKY, University of Utah.

Abstract: The early interpretation of Lakes Bonneville and Lahontan by Gilbert and Russell, respectively, suggested that the lakes were contemporaneous with the whole of Pleistocene time. The Pleistocene then was considered as having two glacial and one interglacial stages. More recent

study of the Pleistocene has revealed four glacial and three interglacial stages. It has been thought necessary, to shift the entire history of Lakes Bonneville and Lahontan into the second part of the Pleistocene with Illinoian and Wisconsin subdivisions.

My own investigation of fossil soils and geomorphology in the area of Salt Lake Valley, has enabled me to reappraise the history of Lake Bonneville in accordance with Gilbert's principle concept, namely, that the whole history of Lake Bonneville was contemporaneous with the whole Pleistocene. Four well known lake shorelines in both lakes Bonneville and Lahontan indicate four high water lake stages which were contemporaneous with the four glacial ages of Pleistocene. Fossil soils studied in the Salt Lake Area seem to support my concept. Data of well logs, stream terraces and shore lines all appear to correlate with glacial and interglacial stages, also suggesting that the lakes existed during the whole of the Pleistocene.

FRIDAY MORNING SESSION, JUNE 20.

The Cache Valley, Dairyland of Utah. ELBERT E. MILLER, University of Utah.

Abstract: Over ninety per cent of the farmers of Cache Valley, on the Utah-Idaho border, milk cows and over one-fourth of the 3,326 farms are dairy farms. Most dairy cows are in herds of five to fourteen animals. About half the gross farm income of Cache County comes from dairying. Short, cool summers and poor drainage encourage pasture and forage crops. Dairy-conscious settlers from New England or northern Europe, research by the Utah State Agricultural College, and the many small farms, all aid in accounting for the significance of dairying.

All three of Utah's commercial milk condensing plants are in Cache County, originally placed to use the cheapest surplus milk in the West. The world's largest Swiss Cheese plant with 13 per cent of the nation's production, began operations in 1942. Annual cheese production averages 730,000 pounds annually, while the annual output of milk condensing plants produce from 60,000,000 to 80,000,000 pounds. Wholesale Utah milk prices have recently risen to the general American average. Feed and labor costs have risen faster than the wholesale milk prices, but retail prices have kept pace with this upswing. The result is that many farmers are selling their cows. Within the past year, the demand for fluid milk by Salt Lake City has reached Cache Valley and a few farmers are now selling to the new market.

The Historical Geography of Olympia, Washington. DALE V. GRAVES, University of Washington.

Abstract: The name Olympia, Washington, brings to mind a state capital and county seat, a busy lumber mill, a famous brewery, the famous Olympia oyster, and a port of transshipment. Today Olympia is all of these. Where the city now stands, as recently as 1847 there was one log cabin surrounded to the west, north, and east by water and to the south by a dense stand of virgin timber. The quest for lumber was the primary motivation to early growth; as the tides of lumber profit rose so did the city expand.

In 1853, Washington Territory was created and Olympia was chosen as the capital, a function which remained in the background in contrast to lumbering until the early 1930's when government became the predominant occupation of the city. A continued expansion of governmental activities, a doubling of population, an increase of its port function, a potential development of chemical manufacture, and a sound program of freeway and city traffic planning are foreseen as belonging to the Olympia of the next quarter century.

The Historical Geography of Everett, Washington. FRANCIS ANDERSON, University of Washington. No abstract received.

The Phosphate Rock Industry of the Pacific. ANTHONY SAS, University of Washington.

Abstract: Phosphate rock, basic element of superphosphate and numerous industrial products, is found in various forms in many parts of the world. In the Pacific limestone rock has been phosphatized by solutions derived from bird guanos and other organic sources. The output of the Pacific Islands is only 8 per cent of world production, but the high quality of the deposits makes them important. Mining of phosphate rock in the Pacific started in the late 1890's. Deposits occur on many islands but the bulk comes from Angaur, Ocean, Nauro, and Makatea, with Nauru the largest producer.

Mining and shipping are similar on all four islands. Rock is open-pit mined and carried by rail to the shore. Very deep shore waters require special moorings for ship loading. The rock is moved by carrier belt, on cantilevers, and tipped directly into a ship's hold. Frequent storms require rapid loading.

The future of phosphate mining in the Pacific is not secure because deposits are exploited intensively and reserves are limited. Nauru and Ocean have the largest reserves, possessing about 140 million tons which, based on present production of over 1 million tons per year, could last about 100 years. Makatea's deposits may last fifty years but the 3 million ton Angaur reserve will be mined in 20 years. Extensive, unworked deposits of phosphate rock seem to exist on some of the Carolinas, Marianas, and New Hebrides, while other sources may be located in the near future.

A Preliminary Study of the Seasonal Distribution of Precipitation in British Columbia. JOHN D. CHAPMAN, University of British Columbia. Published in full in this issue.

FRIDAY AFTERNOON SESSION, JUNE 20.

Mexico, Land of Change and Contrast. DAVID W. LANTIS, University of Southern California.

Abstract: Mexico is a land of numerous contrasts which today is experiencing remarkable transitions that are greatly altering its human geography. The physical environment alone contains sufficient variation in climate and landforms to produce geographic complexity. There is great complexity of soil and vegetation. The multiplicity of Indian groupings and the intermingling of Spanish blood adds complexity to the ethnography.

Perhaps no country in Latin America is experiencing such sweeping changes. By 1950 paved highways had linked almost every back area with the central core-land. The ejido program of the past two decades has affected rural patterns but is a failure, and the need for further agrarian reform is urgent. With over 13,000 factories, Mexico ranks fourth in industry in Latin America; the 50,000 vehicles assembled in 1951 is indicative of expansion. Yet poverty remains widespread and labor has virtually no value.

Developments are startling around Mexico City whose metropolitan population now approaches three million. It has beautiful avenues, advanced designing of office buildings, and beautiful suburbs, yet hundreds of thousands of residents live in slums on the bed of recently drained Lake Taxococo. Mexico is losing its "manana" attitude. Several progressive administrations, American capital, and increasing interflow of American tourists and Mexican farm hands are major factors.

Fiordland, New Zealand's Empty Southwest. HOWARD J. CRITCHFIELD, Western Washington College of Education. Published in full in this issue.

The Livestock Industry of the Deschutes Area, Oregon. SHELDON D. ERICKSEN, University of Oregon. No abstract received.

Patterns of Highway Transportation in the European USSR. WILLERT RHYNSBURGER, Indiana University.

Abstract: Except in the mountainous south and east, Soviet highways principally supplement rail and river transport. Until recently a variety of factors have greatly retarded motor transport. Two classes of roads are distinguishable: (1) "earthen roads" whose distribution in the European part of the Union corresponds roughly with the distribution of settlement; (2) hard-surfaced, all-year highways. Since unsurfaced roads are seasonably unusable, the pattern of paved highways gives a key to motor transport in the Soviet system of communications. Soviet Europe contains about 42,200 miles of hard surfaced highways, arranged in four zones: (1) Karelia, the Baltic Republics,and northern Belorussia; (2) western Ukraine; (3) Transcaucasus; and (4) the Central Industrial Region. In contrast vast areas of the Union lack highways, and such important areas as the eastern Ukraine, the Black Earth Belt, and the Urals are ill-equipped. Long roads, not through routes so much as major oblast highways joined end to end, are supplemented by short lengths of surfaced access highways leading to railway or river stations, industrial plants or mines, machine tractor stations, and similar destinations. With few exceptions, the USSR still has but a rudimentary highway system, which functions chiefly as a local carrier, moving less than one-thirtieth of the nation's freight. Many factors handicap marked expansion of the Soviet network of inter-city highways in the near future.

Urban Rivals of the Middle Rogue River Valley, Oregon. WILLIAM A. ERWIN, JR.,

Abstract: The Middle Rogue River Valley is a relatively isolated area. Formerly devoted to dry farming, it has developed irrigation specialty crops. In past century several communities have aspired to become the metropolis.

Since they now fulfill different functions, the four towns are complementary rather than being rivals.

The first center was Jacksonville, founded around a gold strike in 1851. It became the county seat of Jackson County, but as the diggings petered out, the town declined. Unwillingness to help finance an early railroad left Jacksonville off the main rail line. It lost the county seat and became almost a ghost town. It has recovered as a fruit growing center and tourist attraction. Ashland was settled in 1852 by farmers. Ashland Creek provided power for a sawmill and a flour mill. In addition to its sawmills and irrigated agriculture Ashland now is the educational center of the valley. Grants Pass is a railroad town and a county seat. Sawmills, diversified farming, and gold mining add variety to the town's activity. Medford, newest of the four towns, was founded in 1883 as a railroad station for Jacksonville. Medford became county seat of Jackson County in 1927, and became the agricultural center. Its regional centrality and the long distance from larger centers like San Francisco and Portland have made Medford a wholesale center for the entire Rogue River region.

The Background of Modern Chinese Nationalism. THEODORE HERMAN, University of Washington.

Abstract: Modern Chinese naticnalism is rooted in history and geography. In early times invasions came mostly from the northwest. They were met by walls, garrisons, and political arrangements. In Chinese cultural consciousness awareness of the borders became strong. Impact of the industrialized nations has shifted the invasions to the northeast, east, and south, and the classic defenses no longer work. The eastern quarter contains 78 per cent of the people and most of the economic resources. Likewise, the pressure of opening China's door long ago roused fears that appear today as aggressive nationalism.

The second feature of this nationalism is the demand for internal reforms and a better standard of living, especially by industrialization. Since industry and exports for foreign exchange rest largely on farm products, agricultural improvement is basic. Farm operation must be improved, and industrial opportunities created for the under-employed people. From these two basic needs as the Chinese people see them -- defense and economic improvement -- we can understand some of the background of modern Chinese nationalism.

Change and Variability of Population in the United States. ARTHUR GEDDES, University of California, Berkley.

Abstract: Not only the net change of population, as measured with reference to two census dates, but the manner of change and its regional pulsations are important. These latter types of change can be measured by an index of variability in change. To estimate this variability, determine for intermediate census periods an average deviation from a straight line passing through the totals for the first and last census dates used, say 1900 and 1950. This may be done for various regional units, and the results bring out a series of regional types of variability in change, which then may be subjected to local analysis and interpretation.

This method of population study was first worked out by the author in studies of the population of India published in the Geographical Journal and in the Geographical Review. The United States presents an area of great contrast to India. India, prior to partition, contained one of the world's most static groups of regional communities, mostly close to the limit of mere survival. The United States, in contrast, contains a dynamic, migrant population with a high and advancing living standard.

A Method of Third Dimensional Relief Representations.

JOHN CROSBY, University of Washington.

Abstract: The use of tints and shading to show relief, though known in Europe since the 1890's, have been employed on American maps in recent years. American map companies on their physical maps have generally employed the International Color Sequence of altitudinal tints - a progression from bright green at the lowest elevations through darker green, beige, tan, brown, dark brown to red at the highest elevations. This system is inadequate for depicting relief. And because the eye perceives the brighter colors at the lower elevations more quickly than the "receding," darker colors at the higher elevations, even the over-all relationship between the higher and lower areas appears to be exactly reversed.

The map of East Africa displayed used a different color sequence, applied in steps as listed: (1) Black lightly applied to achieve a light grey, 0-1500 feet; (2) brown ochre, 1500-5500 feet; (3) light green, 0-2500 feet; (4) orange, 4500-7500 feet; (5) yellow, 6500-9500 feet: and (6) lemon yellow, 9500-11,000 feet. Above 11,000 feet paper was left white for snow-capped mountains. Four shading colors were then applied to the southerly, southeasterly and easterly slopes of the ridges as indicated by the coutour lines: (1) Olive green, 0-3500 feet; (2) ochre, 3000-7500 feet; (3) brown, 7000-9500 feet; (4) purple, 9000-up.

The use of merged altitudinal tints in this sequence produces resemblance to the actual areas of high and low elevation. The lighter, more yellow colors appear higher because they "attract" the eye more readily than the "greyed," darker colors at the lower elevations which appear to "recede." The plastic shading in four colors, each of which presents a stronger contrast to the base colors as elevation increases, gives an accurate representation of the true land form, within the limits of the contour interval employed.

FRIDAY EVENING SESSION, JUNE 20.

Annual dinner Memorial Union Tea Room, Oregon State Agricultural College. Address of the retiring President: "The Rogue River Country of Oregon, a Study in Regional Geography." SAMUEL N. DICKEN, University of Oregon. Published in full in this issue.

SATURDAY FIELD EXCURSION, JUNE 21.

A full day field trip from Corvallis to the coast and back was led by James C. Stovall, University of Oregon.

ABRIDGED REPORT OF THE SECRETARY-TREASURER

On June 19, 1952, there were 213 association members, 63 of whom were not in good standing. There were 184 regular and 29 student members. This represents an increase of 29 members over the 1951 total.

Mailings to each member for the year included two news letters, two general dues notices and calls for news, two separate ballots, distribution of Volume 13 of the Yearbook, plus numerous mailings to libraries and institutions concerning issues of the Yearbook.

One executive board meeting held in Portland in October, 1951, concluded arrangements for the 1952 annual meeting and acted upon the problem of affiliation with the Association of American Geographers. The Affiliation Committee later reported the vote as 71 in favor of and 12 against affiliation. Final problems of affiliation will be handled by correspondence with the membership during 1952-53.

After the election of officers for the year 1952-53, President Robert M. Glendinning, University of California, Los Angeles, resigned owing to a misunderstanding concerning his nomination and to previous commitments. J. E. Spencer was reappointed Editor of the Yearbook for another period of three years.

Income Deposits		Withdrawal of Funds	
Bank Balance May 31, 1951	$ 570.56	Printing Yearbook Volume 12	$362.23
Yearbook Sales	164.30	Mailing Volume 12	28.30
Dues and Contributions	481.35	Printing Yearbook Volume 13	320.22
		Postage, Envelopes and Membership Cards	101.19
		Office Equipment	25.39
		Petty Cash Expenses	17.00
		Total Withdrawals	$854.33
Total Deposits	$1216.21	Bank Balance June 17, 1952	$361.88

OFFICERS, 1952-53

President, William A. Rockie, Soil Conservation Service, Portland, Oregon.

Vice-President, Vacant.

Secretary-Treasurer, Francis J. Schadegg, Eastern Washington College of Education, Cheney, Washington.

Editor, J. E. Spencer, University of California, Los Angeles.

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